The REFINER
AND NATURAL GASOLINE MANUFACTURER

JENKINS CRACKING PROCESS

PRODUCES QUALITY GASOLINE

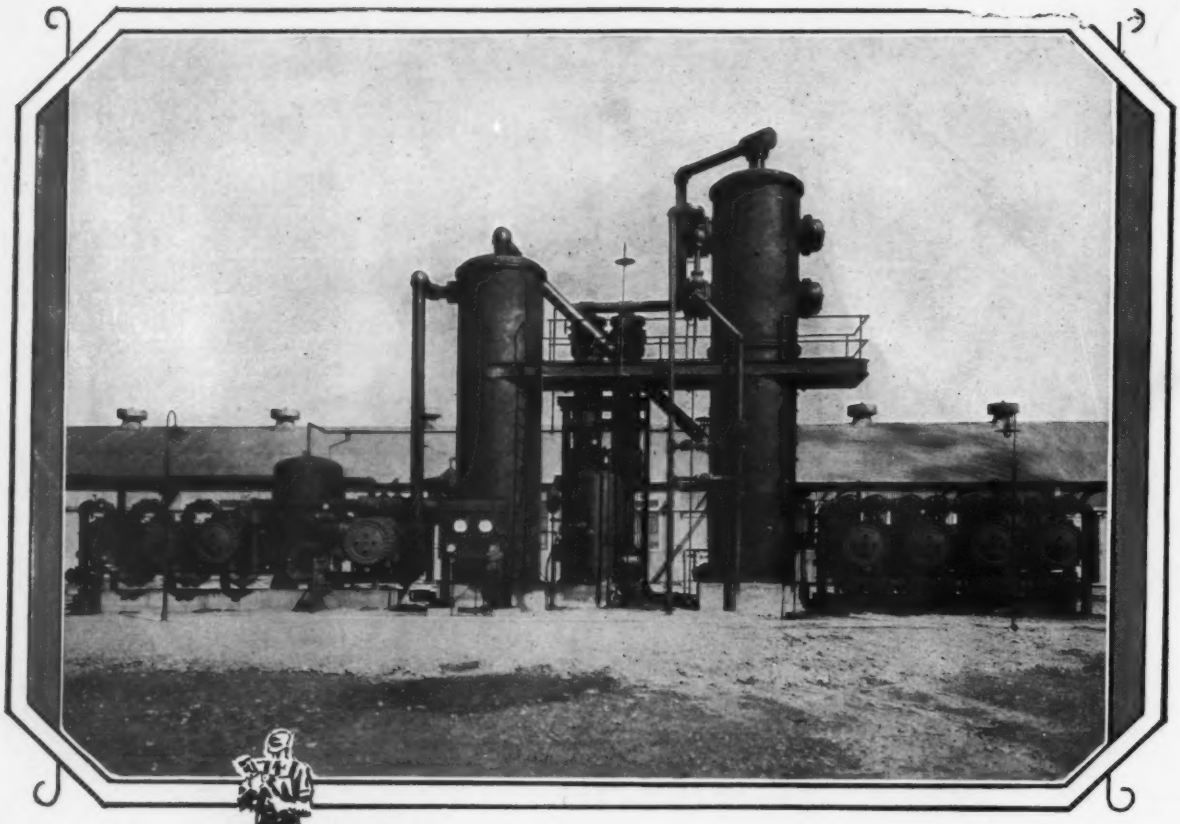
Jenkins Licensees

know the advantages of low operating costs and quality products having found it advantageous to keep all their Units in operation during the present period of reduced margins.

GRAVER Corporation Founded 1857

EAST CHICAGO, INDIANA

NEW YORK Grand Cent. Term. | CHICAGO America Fore Bldg. | TULSA Atlas Life Bldg. | HOUSTON West Building



Portable, Mobile, and Fabricated plants with a range of gasoline capacities up to 40,000 gal./24 hr. *Lower cost per gallon* of gasoline produced ★

BRAUN

Absorption Plants

C•F•BRAUN & CO

Manufacturing Mechanical Engineers

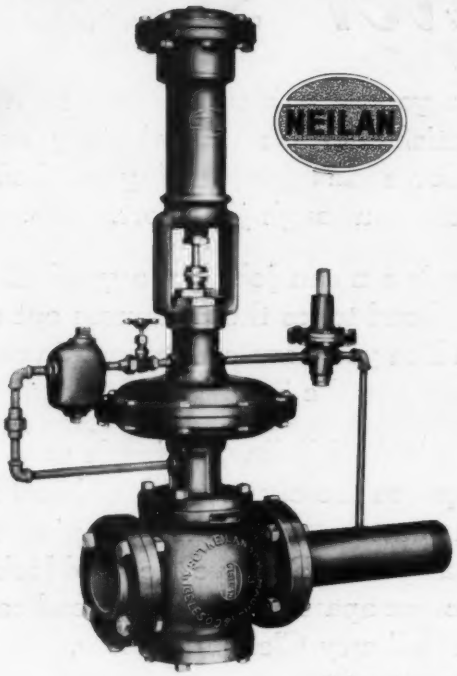
•ALHAMBRA•CALIF•

TULSA • NEW YORK • DALLAS

Entered as second class matter June 16th, 1923, at the Po stoffice at Houston, Texas, under the Act of March 3, 1879

Constant Boiler Pressure

In Absorption Plants, Refineries and Drilling Boilers



Neilan Combination Boiler Governor and Fuel Gas Regulator, No. 87.

Regardless of steam requirements or fluctuating gas pressure, the Neilan Combination Boiler Governor and Fuel Gas Regulator No. 87 will hold steady boiler pressure. The slightest drop in steam pressure will cause the governor to open and admit the proper amount of gas to furnace to take care of increased load. When firing low or under no load, the governor will throttle down or close to a pilot light.

May be set to feed burners exactly the right amount of gas for perfect combustion. Movement of main valve is gradual and does not permit sudden violent increase in fire. Prevents damage to firebox, flues and stack, and saves fuel.

Steam pressure may be carried within one pound of blow-down of pop safety valves. Higher steam pressure may be carried and greater capacity obtained from boilers. Or steam pressure may be carried lower than usual, because there is no delay or drop of several pounds pressure before governor opens to admit required amount of gas.

On account of extreme sensitiveness, accuracy and close regulation, the Neilan Combination Boiler Governor and Fuel Gas Regulator is the only governor that will give full satisfaction with low pressure gas burners. No gas regulator required.

NEILAN, SCHUMACHER & CO.
641-651 Santa Fe Ave.,
Los Angeles, California

Branch Office: 626 Mayo Building, Tulsa, Okla.
P. H. Wilkinson, Manager.

Representatives:
Maintenance Engineering Corp., 2000 Harrington St., Houston, Texas.
Pelican Well Tool & Supply Co., Shreveport, La.

"You Can Be Sure of Neilan Products"

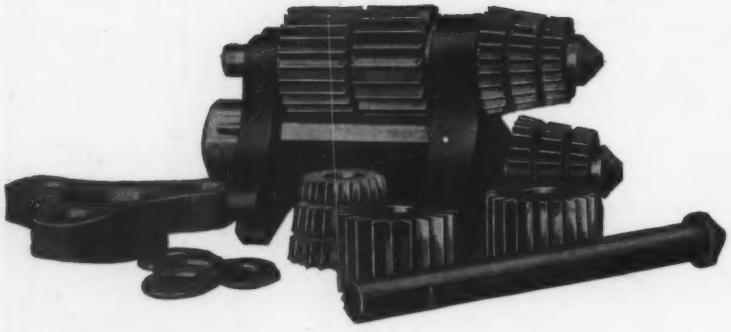
To the men who battle boiler scale—

YOU appreciate a good tube cleaner. You know the feeling of solid satisfaction as the whirling cutters churn their way down the tubes, tearing off the scale in chunks, and cutting a tough job short.

For tube cleaning is a mean job, but a good cleaner with a fine cutter head takes the meanness out of it. That is why men like you have cast a heavy vote for the Liberty Cleaner and the "SF" Cutter Head.

This "SF" Head, pictured below, is simple as well as effective. It comprises merely a spider, head lock, three pins and the cutters. No arms, arm pins, trunnions or other small parts. Remove the head lock and the entire head comes apart. The "SF" Head can be furnished with all Liberty Cleaner Motors.

Ask for Catalog Z-2, Covering the full line of Liberty Cleaners.

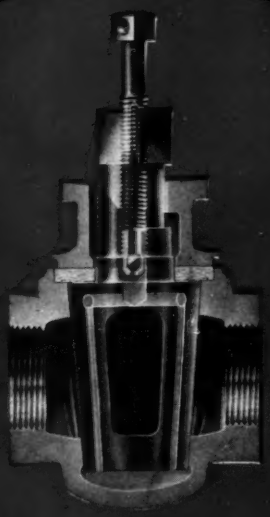


The Liberty "S-F" Cutter Head

Z-1045

Liberty Manufacturing Co.
Jeannette, Pa.

Mention Where You Saw the Advertisement



Revolutionizing valve control

In the Refining Industry the lubricated plug valve was unknown a few years ago. Leaks had to be tolerated. Stuck valves were more the rule than the exception. Then Merco Nordstrom Plug Valves were introduced and valve service was revolutionized.

The principle of *lubricant under pressure*—to guard the plug against sticking, corroding and to prevent leaks—has been enthusiastically accepted.

SPECIAL MERCO LUBRICANT HAS BEEN COMPOUNDED FOR DIFFERENT OPERATING SERVICES. ASK FOR CATALOG.

MERCO NORDSTROM VALVE CO.

SUBSIDIARY OF THE MESSILL COMPANY

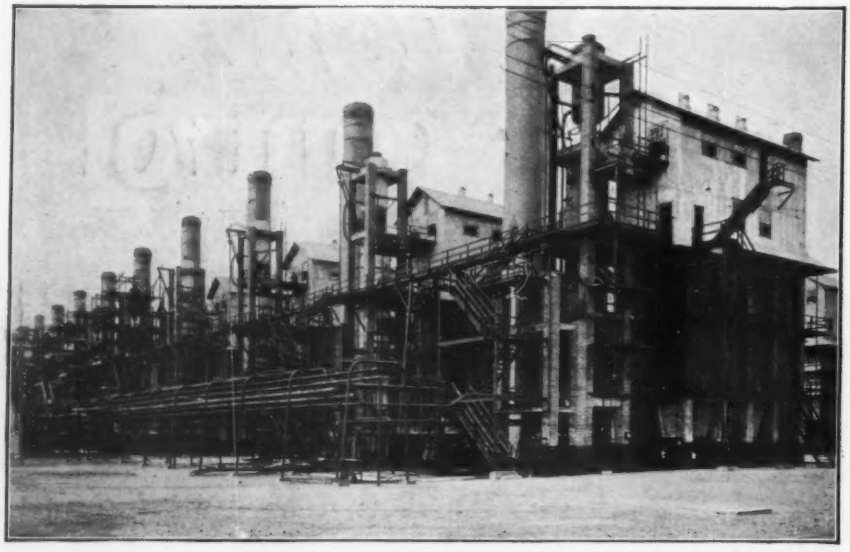
Engineers—
San Francisco, 121 Second St.
Chicago, Peoples Gas Building
Cleveland, Ohio, 325 Engineers Building
Western Factory: Oakland, California

Manufacturers
New York, 11 W. 42nd St.
Houston, 1315 Petroleum Bldg.
New Orleans, 1501 Masonic Temple Bldg.
Eastern Factory: Belleville, New Jersey

AGENCIES IN PRINCIPAL CITIES

Merco Nordstrom PLUG VALVES

The Holmes-Manley *Cracking* Process



A New Installation
of Holmes-Manley Units nearing
completion at the Port Arthur
works of The Texas Company.

Mention Where You Saw the Advertisement

The Holmes-Manley *Cracking* Process

Flexibility of Operation.

High Yield of Quality Gasoline direct from the Unit.

Fractionation and Condensation under Full Operating Pressure.

High Yield of Liquid Products with a minimum yield of fixed gas and carbon.

Low yield of Residue Fuel Oil of good Quality.

Relatively low Operating Temperatures.

Ease of Control.

Long Runs and High percentage of Operating Time.

Low Labor and Fuel Costs.

Address Inquiries to

THE TEXAS COMPANY

W. S. S. RODGERS

17 Battery Place, New York, N. Y.

Branch Office

816 Palace Building, Tulsa, Okla.

SUNOCO

Now....

is the time for

BETTER RECOVERY

Sunoco Absorption Oils 630 *and* 670

Will help you secure the greatest possible profits

Now more than ever before Gasoline Plant owners must secure greater yields and more efficient plant operation to secure the greatest possible profits.

Hundreds of plant owners are securing greater recovery through use of a Sunoco oil manufactured for use with their special design of plant.

Write, wire or phone, for quotations and samples. If desired a representative will call.

SUN COMPANY

Petroleum Bldg., Tulsa, Oklahoma

Refineries at

Marcus Hook, Pa. Yale, Oklahoma Toledo, Ohio

Modern Machinery and Skilled Workmen—

at Your Service

The expansive KAW plant contains the most complete up-to-date machinery for producing refinery equipment that money can buy. In this modern steel workshop, highly skilled craftsmen build quality, durability and super-strength into every KAW product.

Then before any refinery equipment leaves the KAW plant, it undergoes a final minute inspection to insure its being up to the KAW standard of built-in quality.

That's why KAW-Built Refinery Equipment is so reliable and long-lasting—why it will pay you to get KAW specifications and prices.

HORIZONTAL TANKS
RUNDOWN TANKS
CONDENSER BOXES
STORAGE TANKS
BUBBLE TOWERS
STACKS &
STILLS

KAW

We guarantee quick shipment of any kind of refinery equipment to any place. Write, wire or phone your order and save both time and money.

KAW STEEL CONSTRUCTION CO.

General Office and Plant: 1st and Walker Ave.
KANSAS CITY, KANSAS

Softened Water Saves $1,000.00 A Year On Condenser Costs

ON just one item alone the Paige-Jones upflow zeolite water softener is saving the Gilmore Oil Company $1,000.00 a year.

Condenser coils are now kept free of scale. Cleaning costs are eliminated.

Add to this saving, the revenue accruing from more efficient condensation and the value of the Paige-Jones water softener multiplies.

Paige-Jones upflow zeolite softener in the Gilmore Oil Refinery, Los Angeles

Gilmore Oil Company is only one of the many refineries using Paige-Jones equipment for treating water. It may be for cooling coils, for engine jackets, or for boilers—sometimes all three.

Water softeners in refineries return definite incomes. So much so that in a few months they completely pay for themselves.

Have a Paige-Jones engineer make a study of your water supply and make a report as to the possible savings.

PAIGE & JONES CHEMICAL CO. *Inc.*

General Sales Office, Technical Dept. & Works: HAMMOND, IND.
Executive Offices: 461 FOURTH AVE., N. Y.
Offices in Principal Cities.

Why the Upflow System is More Economical.

In a recent test with a downflow zeolite system, the Paige-Jones upflow softener

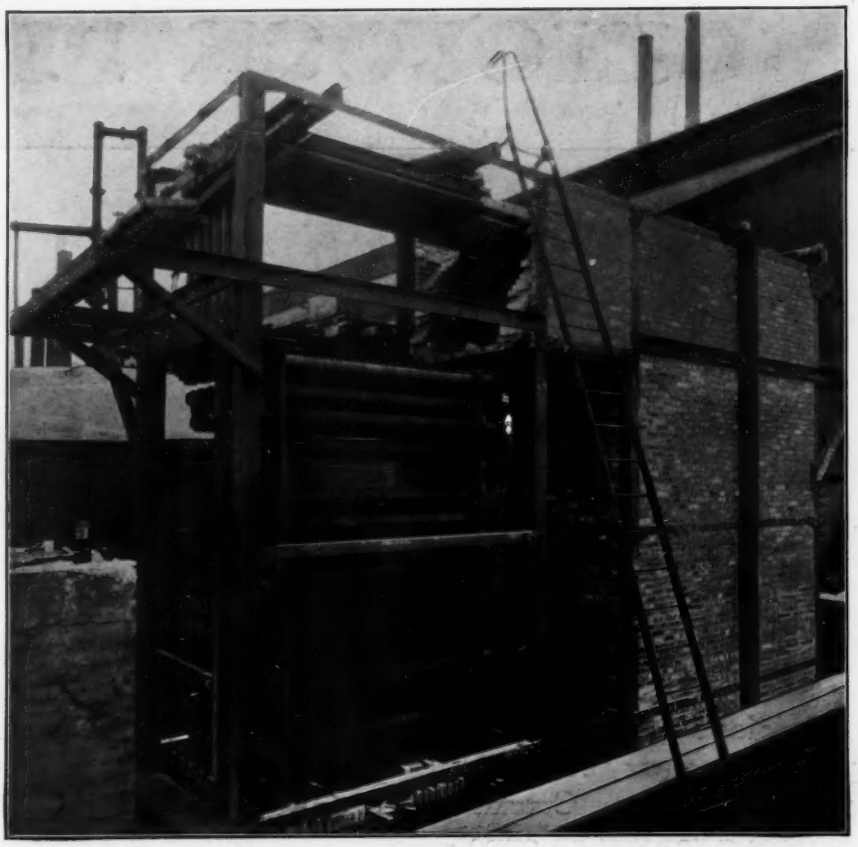
- gave 27% more water per regeneration
- required no water for backwashing, (as against 1425 gallons)
- required about 3/5th of water for regenerating
- consumed 8% less salt for regenerating
- took less than half the time to regenerate.

Paige-Jones originated and developed the *upflow* zeolite softener.

PAIGE-JONES WATER SOFTENING

ZEOLITE AND LIME SODA SOFTENERS · PRESSURE SAND FILTERS ·
BOILER FEED WATER TREATMENTS · HOUSEHOLD WATER SOFTENERS ·

Mention Where You Saw the Advertisement



CONTROLLED HEATING

Foster Tube Still design prevents overheating by rapid and positive circulation, assures uniform heating by arranging all tubes to supply heat with practically equal effectiveness, secures minimum fuel consumption by gradual, continuous, thorough heating effect with complete combustion.

Foster Stills successfully take an overhead of 90% of the throughput without cracking. In over 500 installations Foster Stills are obtaining greater yields of overhead distillate with less fuel consumption than is possible with older types of equipment.

POWER SPECIALTY COMPANY
111 Broadway, New York
Branches in all Oil Centers

FOSTER
The TUBE STILLS
with the protected surface

Mention Where You Saw the Advertisement

THE OHIOLOCK PLUG

To Replace Old Style Compound Plug

The "Ohiolock" plug now takes the place of ordinary compound plug used in Cross Cracking units. This gives you an opportunity of gaining "Ohiolock" advantages in your present installations.

This more efficient closure enables you to cut your cleaning costs by reducing to a minimum the time needed to remove the plugs and put them back in place.

Simplicity and ease of operation make the new plug much quicker acting than the old. Your stills get back on stream quicker.

It cannot stick. There are no threads to corrode. When in place, it is there to stay until you are ready to take it out. It is then removed without fuss or trouble. You will never have to put a torch on "Ohiolock" to remove it.

Write for "Ohiolock" Bulletin

The Ohio Steel Foundry Co.

Springfield, Ohio

SALES OFFICES:
HOUSTON—HARRISBURG PIPE & PIPE BENDING CO., OF TEXAS
CHICAGO—PEOPLES GAS BLDG.
NEW YORK—76 WEST ST.
PHILADELPHIA—22 SO. 18TH ST.
LOS ANGELES—4920 LOMA VISTA AVE

PLANTS IN SPRINGFIELD LIMA

Pioneers in Return Bends for Pipe Stills

$2.50 per GALLON

for COOK'S READY-TO-MIX

ALUMINUM TANK PAINT

POPULAR demand and quantity production enable us to offer Cook's Ready-to-Mix Aluminum Tank Paint at this new low price.

Science has proved that Aluminum Paint, to be most effective, must be applied when freshly mixed. Because "you mix it on the job," Cook's Aluminum Tank Paint is always sure to be fresh. And because it *is* fresh, it has greater "leafing power," it wears better and reflects light and heat more effectively. The improved Cook package assures easy and foolproof mixing in exactly the right proportions—giving you bright, shiny, *new* paint, with a covering capacity of 750 square feet to the gallon. The greater leafing power of the fresh Aluminum "seals in" the paint, giving maximum wear and maximum heat reflection. One coat will do the work. It may be applied with either brush or spray.

When repainting over old paint, apply Cook's Aluminum Paint direct, without a priming coat.

Unpainted tanks require a priming coat, for which we recommend Cook's Rust Inhibitive Primer, in five gallon cans at $2.25 per gallon. Covering capacity, 500 square feet to the gallon.

Send us the dimensions or capacity of your tanks with your order; and we will send you the amount of paint you will need to do the job.

Prices quoted are F. O. B. at any of our factories or branches. Absolute satisfaction guaranteed or your money back.

Powder in the Small Bucket (A) Liquid in the Large Bucket (B) Together in a 5-Gallon Package

The large bucket "B" contains the Liquid and a separate bucket "A" which contains the Aluminum Powder. Remove the lid of the large bucket and take out the smaller Bucket containing Powder. Cut out the soft tin top of Bucket "A" and dump the Powder into the Liquid. Stir well with a wide, flat paddle that is long enough to reach the bottom of the large bucket.

Mix It on the Job as You Use It—

This *fresh* mixture gives a bright, shiny paint of superior quality, containing exactly the proper proportions of Powder and Liquid. Science has taught us that Aluminum Paint must be freshly mixed to be most effective. This unique Cook package assures *easy, foolproof mixing.*

Fight Sunshine with Cook's Tank Paint —Save 200 Barrels Yearly, Per Tank!

Government field tests on 55,000-barrel crude oil storage tanks show that Aluminum-painted tanks lose by evaporation 200 barrels less oil in a year's time than black tanks.

Black tanks absorb the heat from the sun's rays, causing excessive evaporation. Aluminum-painted tanks *reflect* the sun's rays, and thus remain cool. It's cheaper to paint a tank than to lose 200 barrels by evaporation!

Cook Paint and Varnish Company

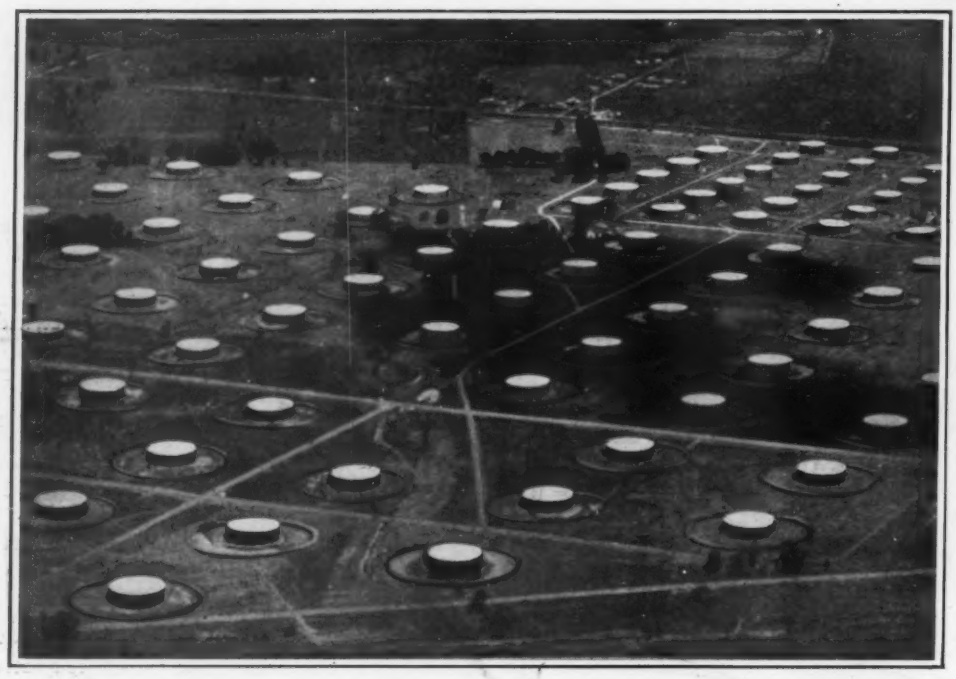
Pioneers in the Manufacture of Specialized Paints for the Oil Industry

Factories: Kansas City, Fort Worth, St. Louis, Houston

Branches: Chicago—Omaha—Wichita—Oklahoma City—Tulsa—Dallas—Denver—Kansas City, Kansas—St. Joseph, Missouri

Over 50,000,000 Bbls.

storage capacity now protected



by Johns-Manville vapor-tight insulated tank tops*

**Patented. Other patents pending*

JOHNS-MANVILLE

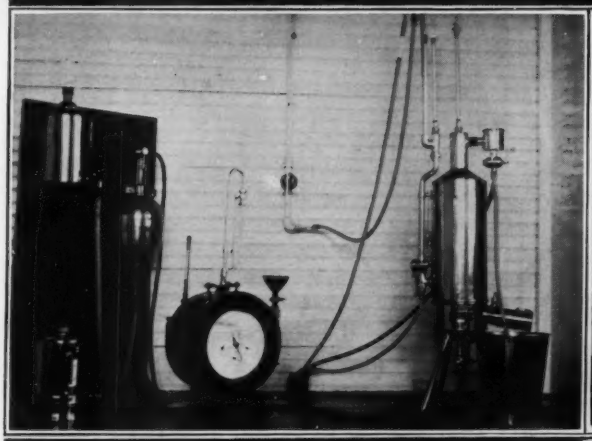
Oil Industry Department

JOHNS-MANVILLE CORPORATION
MADISON AVENUE AT 41ST STREET, NEW YORK

Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

BRANCHES IN ALL LARGE CITIES. FOR CANADA:
CANADIAN JOHNS-MANVILLE CO., LTD., TORONTO

In the Houston Pipe Line



METRIC orifice METERS

The above view shows the Gas Calorimeter and Testing Equipment installed at the Bryan Mound laboratory of the Houston Pipe Line Company.

The above Metric Orifice Meters were installed by the Houston Pipe Line Company for the Freeport Sulphur Company at Bryan Mound, Texas.

the men in TEXAS

—who are doing big things—such as the laying of lines of the kind recently completed by the Houston Pipe Line Company—are selecting Metric instruments and equipment for measurement and heating value determinations in natural gas and gasoline work.

Metrics put SURE in meaSUREment

WESTCOTT & GREIS, Inc.

Sales Service

DALLAS TULSA LOS ANGELES

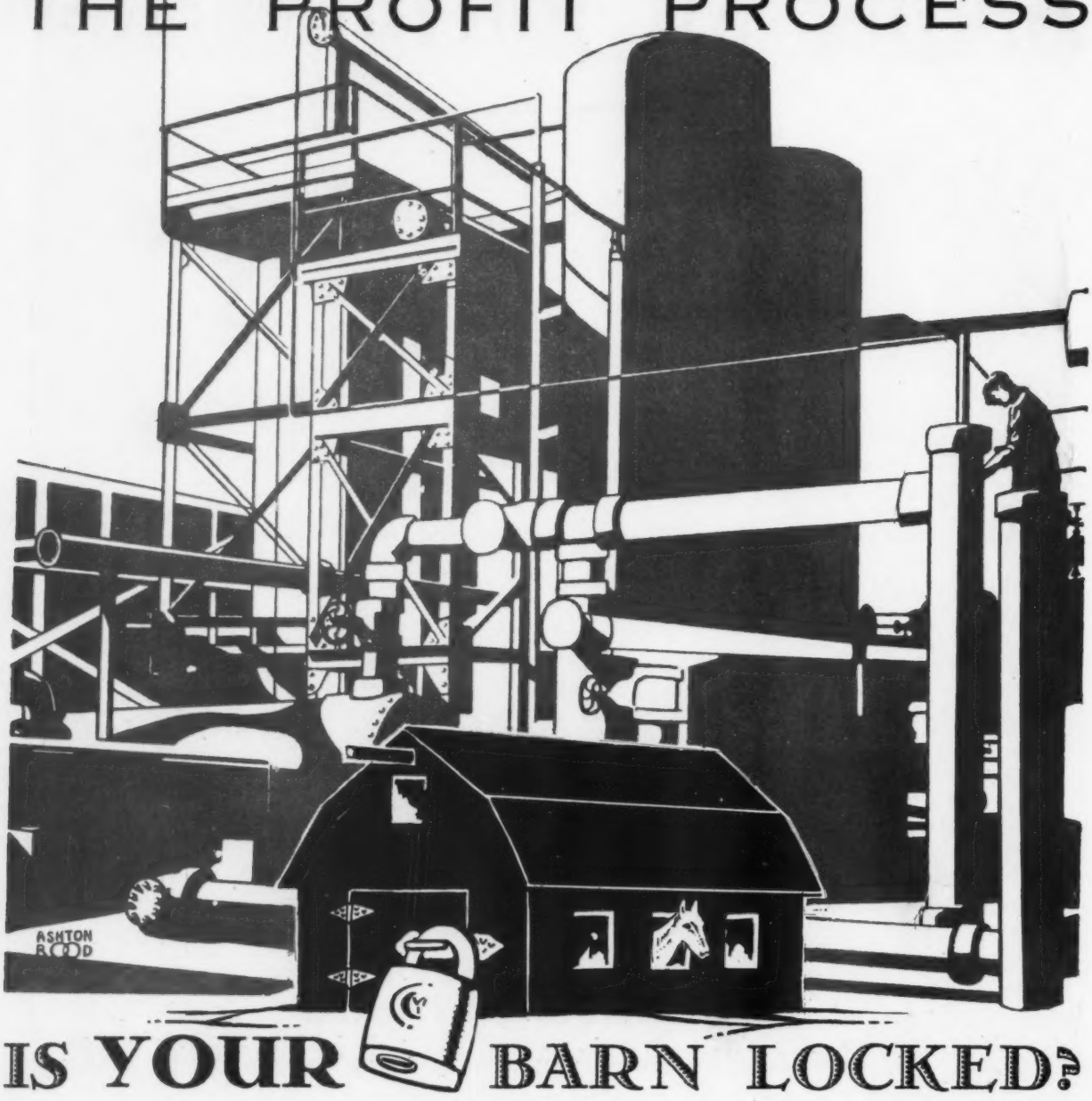
METRIC METAL WORKS

of the American Meter Company-Inc.

ERIE - PENNSYLVANIA - U-S-A

Mention Where You Saw the Advertisement

THE PROFIT PROCESS



IS YOUR BARN LOCKED?

LEGEND

Barn—Your Refinery
Horse—Vapors
Thief—Evaporation
Lock—Newton Plant

A NEWTON Vapor Recovery Plant is to your refinery what a padlock is to a barn. It stops losses!—yet is superior to the lock because it earns a revenue. ¶ The comparison is perhaps crude but the facts are there. Your present losses are paying for a Newton Plant. Install one, own it, and save the difference. ¶ Newton plants for the recovery of refinery vapors are now being installed in Illinois, Pennsylvania, New York, West Virginia and Kentucky. ¶ Why not request the names of refiners who are already using this "Profit Process." Our representatives will gladly give you complete details, or show you plants already in operation.

NEWTON PROCESS MANUFACTURING CO.

FULLERTON (Near Los Angeles) CALIFORNIA

HURLEY BROTHERS
Kennedy Building
Tulsa, Oklahoma

THE NATIONAL SUPPLY COMPANIES
General Offices: Toledo, Ohio
and All Stores

Foreign
THE NATIONAL SUPPLY CORP.
120 Broadway, New York

Mention Where You Saw the Advertisement

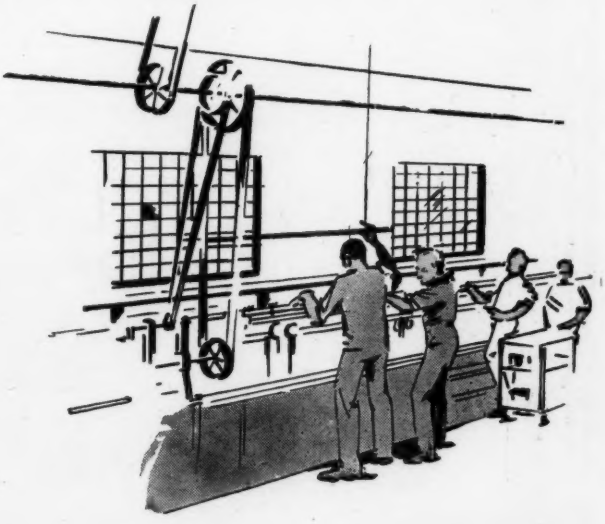
A special job at first

now

a standard equipment

FISHER
TRADE MARK
REGISTERED

The Fisher Steam Trap, Type No. 33, a special job at first now a standard piece of equipment that you will see functioning successfully in many places where it is required to remove the condensate. At the refinery it functions properly and conduces towards the efficient operation of the plant, thereby lowering costs and saving dollars. In the field when hooked on to a steam line, it increases the efficiency of steam engines by providing dry steam at all times. It embodies the most advanced scientific principles; its mechanical construction is excellent and a series of the most exacting tests have proven its superiority.



THE FISHER GOVERNOR COMPANY

1314 Fisher Building
MARSHALLTOWN, IOWA, U. S. A.

Fisher Steam Trap, Type No. 33, removing the condensate from heat exchangers, installed in the plant of the Hull Gasoline Company, at Winfield, Kansas.

THE M. W. KELLOGG COMPANY

The construction of new equipment is a burden too often added to the heavy load borne by a refinery's operating force. Our business is to assume the responsibility for the design, manufacture and erection of refinery equipment.

We do not consider our work complete until we have successfully operated the equipment which we have erected.

The Cross Cracking Process—Pipe Stills—Bubble Towers—Heat Exchangers—Gray Treating Towers.

The Cross Cracking Process—Pipe Stills—
Bubble Towers—Heat Exchangers—Gray Treating Towers.

THE M. W. KELLOGG COMPANY

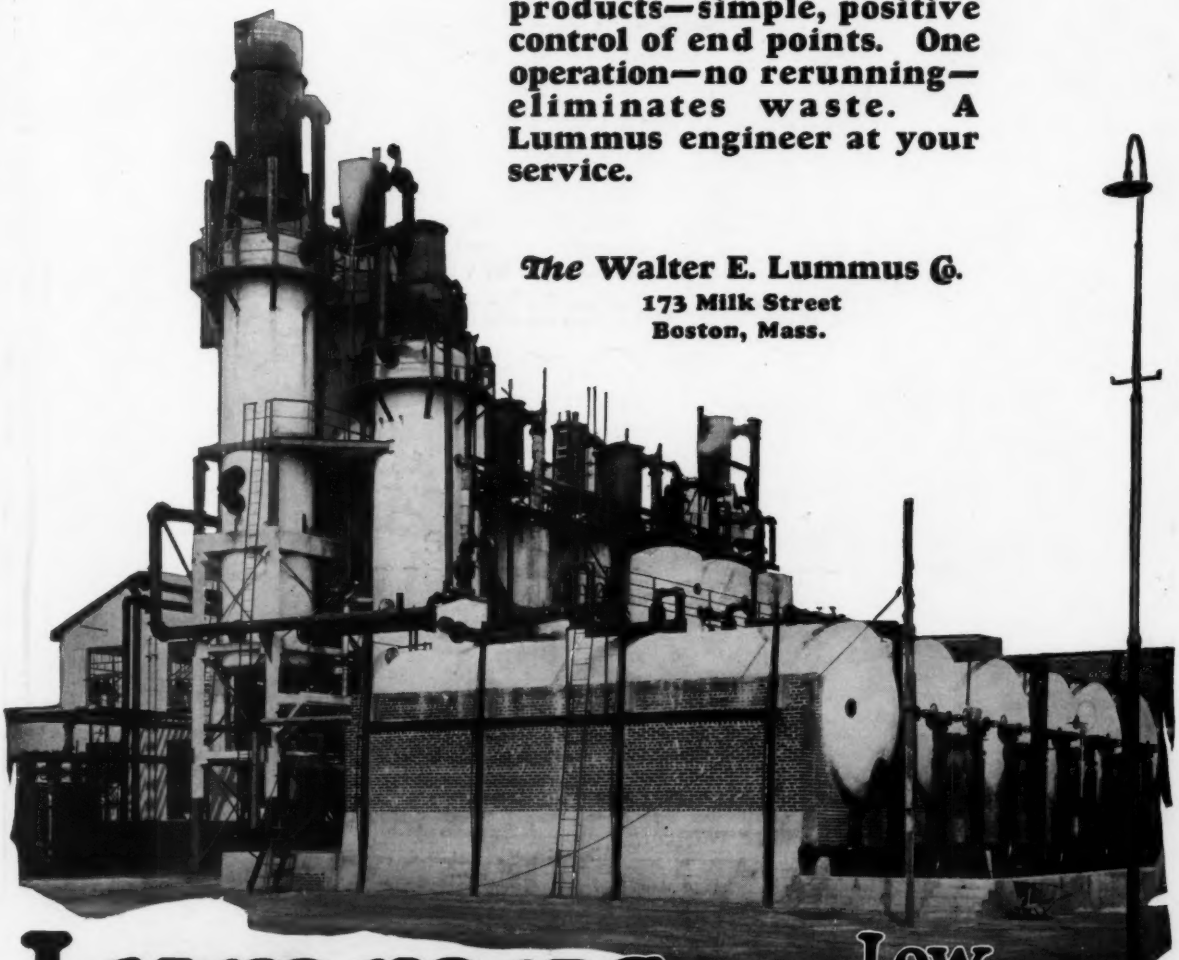
7 Dey Street, *New York City*

Branch Offices:
700 Baltimore Ave., Kansas City, Mo.
444 Market St., San Francisco, Calif.
1019 Hellman Bank Bldg., Los Angeles, Calif.

Efficiency

In petroleum refining is assured with Lummus Low Temperature Refining Systems. Recovery of ALL products—simple, positive control of end points. One operation—no rerunning—eliminates waste. A Lummus engineer at your service.

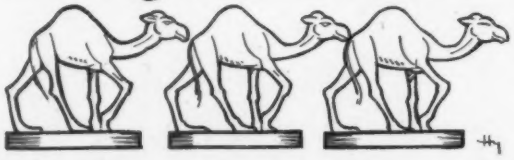
***The* Walter E. Lummus Co.**
173 Milk Street
Boston, Mass.



Lummus Low Temperature Refining Systems

That GAS from the Well
It's all WET
When it floats into a
CAMPBELL ABSORBER.

But it's as DRY as a W.C.T.U.
Meeting when it leaves



You'll walk a mile
To see a CAMPBELL

Ask for catalog

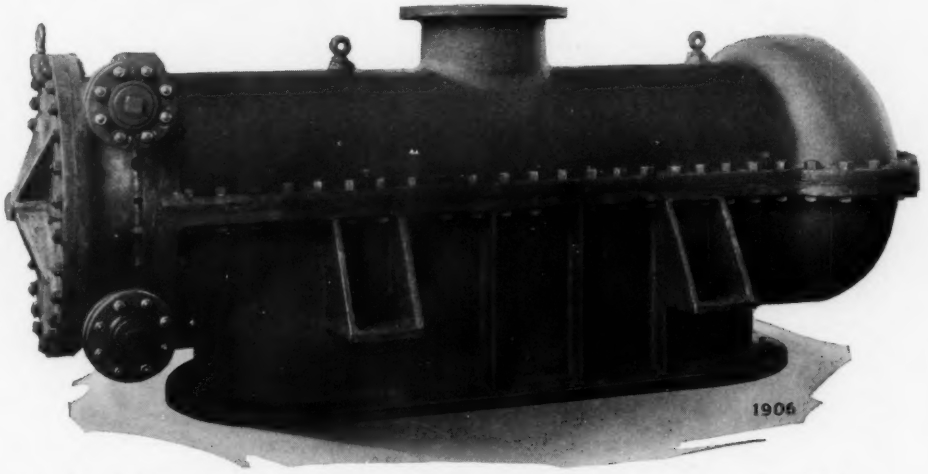
J. A. Campbell

Natural Gas Engineer
Consulting—Designing—Construction
P. O. Box 669 Long Beach, Calif.

CAMPBELL
OIL FROTH
absorber

Mention Where You Saw the Advertisement

The Difference Between
Vacuum Apparatus and High Pressure Apparatus



Split Shell Heat Exchanger for Vacuum Service (Patent Applied for). Notice large vapor inlet.

The problems to be met in designing vapor heat exchangers and oil condensers for high vacuum, are radically different from those encountered in high pressure work. Vacuum apparatus must have ample space for the flow of vapors. The volumes involved are much greater, and the allowable pressure drop much less. Where a pressure drop of several pounds is allowable above atmospheric pressure, a pressure drop of half an ounce is too much at a high vacuum. The Wheeler Condenser and Engineering Company have specialized in the production of high vacuum apparatus, and have built many vapor heat exchangers and oil condensers for vacua of 29½ inches or above.

WHEELER
Oil Refinery
Equipment

HEAT EXCHANGERS
(Liquid to Liquid)
VAPOR HEAT EXCHANGERS
FINAL CONDENSERS,
VACUUM CONDENSERS,
PARTIAL CONDENSERS
THERMO COMPRESSORS.

Other Products Include:

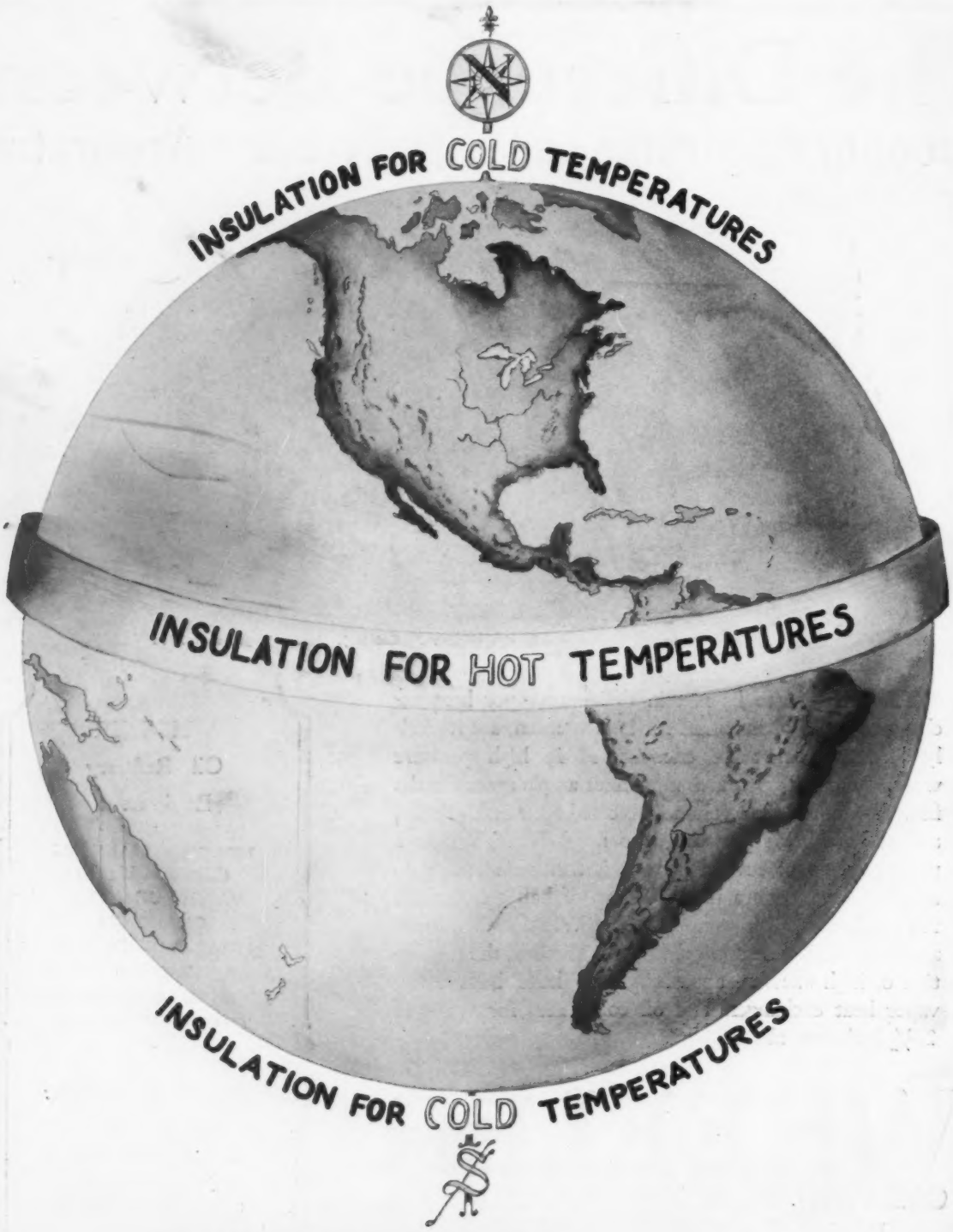
Cooling Towers,
Surface Condensers,
Jet Condensers,
Steam Jet Air Pumps,
Expansion Joints,
Heaters,
Evaporators,
Centrifugal Pumps,
Brass and Copper Tube and Pipe

WHEELER
CONDENSER & ENGINEERING CO.
Works, **CARTERET, N.J.**
and NEWBURGH, N.Y.
Main Office—149 Broadway, New York City

LOCAL OFFICES:

Birmingham, New Orleans, Boston, Philadelphia, Chicago, Phoenix, Cincinnati, Pittsburgh, Cleveland, Portland, Ore., Dallas, Salt Lake City, Denver, Seattle, Havana, San Francisco, Kansas City, Mo., Vancouver, Los Angeles

99



BANROCK SHIELDS—
A WORLD OF TEMPERATURES—

FROM the equatorial heat of commercial ovens to pipe covering or in any place where heat should be conserved, BANROC in its many forms has met world wide acceptance.
In the frigid zones—for refrigeration it has proven its value in retaining cold to the highest degree.
BANROC is reclaimable—it outwears the parts it covers and may be used over and over again.

It costs less—

You might write for a booklet on your particular problems—of course it's free—We'll be glad to send it.

BANNER ROCK PRODUCTS COMPANY
Alexandria, Indiana

Absorption Tanks
made from
"NATIONAL" HAMMER-WELD PIPE

Forged into one homogeneous shell by the "hammer and anvil" process on a large scale, thus entirely doing away with rivets and overlapped seams. This means a smooth interior surface—high bursting strength—and leak-proof construction; and, of particular importance, the whole vessel is annealed at one time to eliminate any stresses after all welding is done.

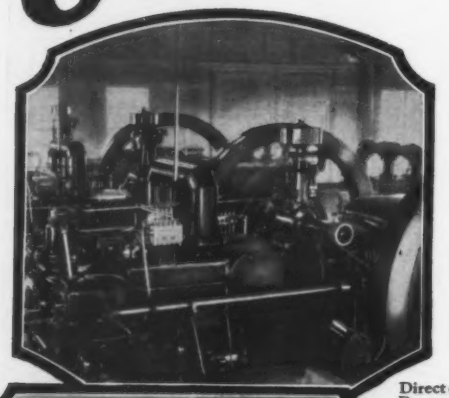
As heads, necks, orifices and other projections may be hammer-welded to the shell, the consequent freedom from internal projecting rivets and seams gives greater efficiency and working capacity and makes the vessels easy to clean. After the tanks are completed, including all nozzles and attachments, they are tested to a hydrostatic pressure of 50 to 100% in excess of the working pressure, and the welds are hammered with a ten-pound sledge during the test.

National Tube Company has ample facilities for executing a wide range of special designs in Oil Refinery Vessels, including absorption tanks, expansion chambers, stills, etc., and our engineers will be glad to cooperate with you and offer suggestions concerning this work at any time. Our Bulletin No. 13 contains a fully illustrated chapter on High Pressure Vessels. Write today for your copy—sent upon request.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

District Sales Offices in the Larger Cities

For *Gasoline Plants, Booster Stations and for Flowing Wells*



Direct driven Bessemer Compressors in an Oklahoma Natural Gas Co. booster station.

An installation of 200 H. P. Bessemer Four-Cycle Compressor in the Rosecrans plant of the Industrial Fuel Supply Company

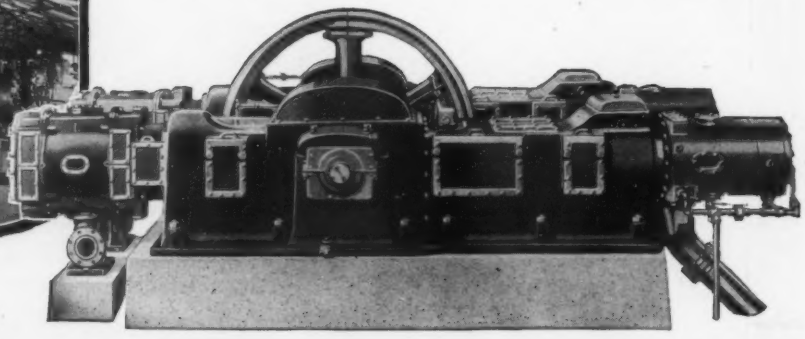
Bessemer Type Ten Compressors in the Strothers blowing plant of the Pure Oil Co.

NO MATTER what service you may have for a compressor, you must have compression efficiency, high average running time and low maintenance and operating cost to make your compressor investment a profitable one.

The reason there are so many Bessemer Compressors in service today is simply because Bessemers have proved their greater value by actual performance in all types of service, under all field operating conditions.

The Bessemer average of 99%+ running time is consistently maintained in gasoline plants, booster stations and for flowing wells. Their maintenance cost is invariably lower, their life of service longer and their depreciation less. Any Bessemer compressor user will tell you convincingly why Bessemers are better. Ask one.

THE BESSEMER GAS ENGINE COMPANY
18 York Street :: :: Grove City, Pa.



BESSEMER

TWO-CYCLE AND FOUR-CYCLE COMPRESSORS

NATURAL GASOLINE

UNIFORMITY

Motor fuel must be uniform if a permanent trade is to be built on your brand.

Uniformity may be easily controlled by blending to your standard specifications, using in this process the required percentage of

NATURAL GASOLINE

And the use of Natural Gasoline gives to refined gasoline non-detonating, even-burning, quick acceleration and consistent motor performance. Virtues which will help to build and hold gasoline consumers confidence.

Many interesting facts concerning the values of Natural Gasoline have been developed by the program of research being conducted by this Association. Write for these valuable bulletins to Research Department, Association of Natural Gasoline Manufacturers, Cosden Building, Tulsa, Oklahoma.

ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS

RESEARCH DEPARTMENT ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS

Refractory Efficiency that fits the need ... and at a lower cost!

Quality equal to more than 85% of Fire Brick Uses

A local product giving Southwestern Refiners a lower freight cost

That's how

TEXAS FIRE BRICK

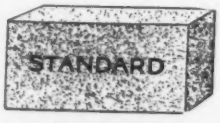
Serves Southwestern Refiners

Athens Brick & Tile Co., Athens, Texas

Texas Clay Products Co., Malakoff, Texas

Elgin Butler Brick Co., Austin, Texas

Write Any Member Listed for Facts and Figures on Your Requirements

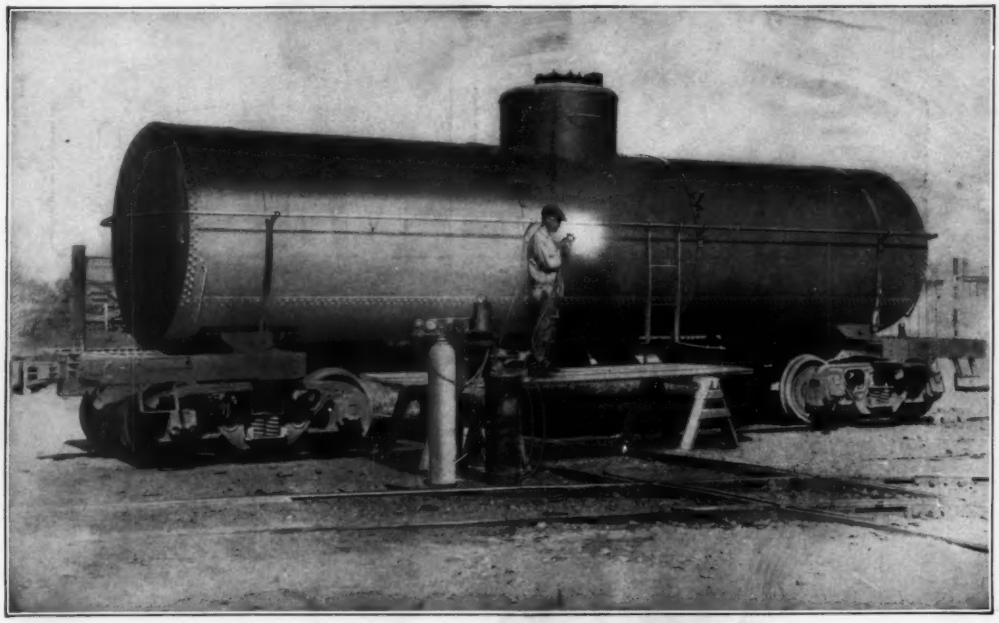


Acme Brick Co., Ft. Worth, Texas

Texas Fire Brick Mfrs. Ass'n

Promoting Texas Fire Brick Economies

Coating TANK CARS—another economical use for—



METALAYER

The "Putting-on Tool"

METALAYER will greatly increase the life of Oil Refinery Equipment by spraying thereon, coatings of corrosion or acid resisting metals, in molten form.

With METALAYER, coatings can be applied on ANY SURFACE regardless of size, shape or location, and successive coatings of the same or different metals may be used, at the will of the operator.

In addition to applying protective coatings, METALAYER is widely used for Filling-up blow holes in castings,—adding weight or dimension, or for securing attractive and durable Decorative Effects.

To appreciate the apparent miracles which METALAYER accomplishes, you should see it in operation at our fully equipped Demonstration Plant in Philadelphia. If you can't come to Philadelphia, the next best thing to do, is to send for our new METALAYER BOOK.

METALAYER *and the process of Metal Spraying are patented in all countries.*

—and what's more, coatings of METALAYER "stay put"; in fact, they can be Turned, Drilled, Ground, Filed or Polished.

METALAYER
METALS COATING COMPANY OF AMERICA
CLEVELAND-CHICAGO
495-497 N. 3rd St. Philadelphia
Berlin and Hamburg Germany
Prague, Czecho-Slovakia
London, England

Kindly send me a copy of the new MetaLayeR Book, gratis.

Mr. ..... Title .....

Co. Name .....

Street .....

City ..... State .....

R-6

SAFEMCO PAINTS

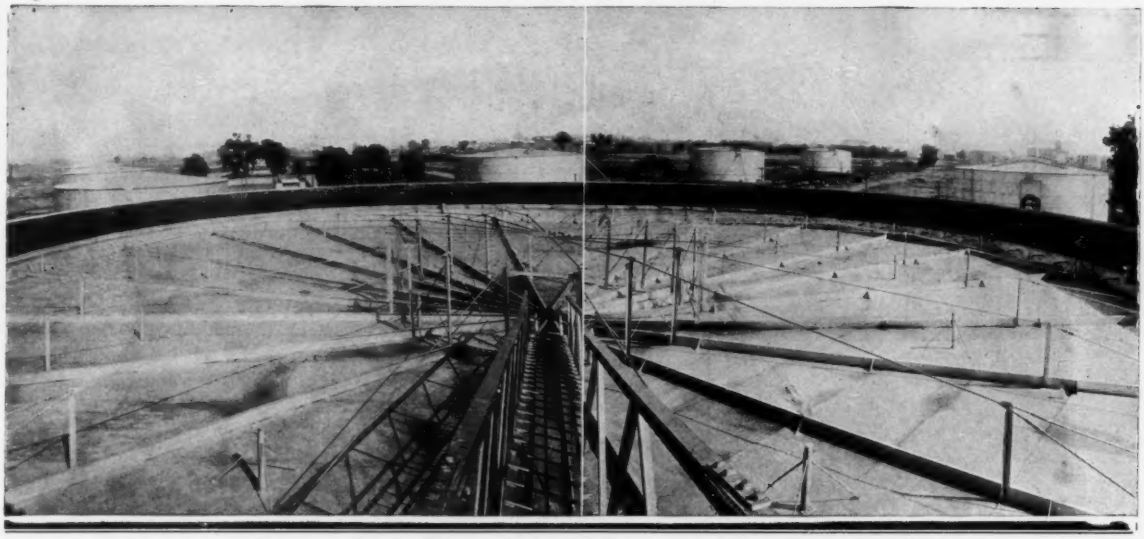
All Over the Southwest!

Used and Recommended by Largest Oil Companies

AMERICAN PAINT & SUPPLY COMPANY

DALLAS, TEXAS

Mention Where You Saw the Advertisement



Suppose you multiply this saving by 197,100

WHEN this tank handles 5,000 barrels of gasoline daily, the Wiggins Roof is responsible for a saving of 6.5 barrels as compared to the evaporation that would result in an ordinary gastight tank. This is based on both theory and experience showing average savings amounting to about 0.13% of the total volume of gasoline pumped.

Since about 900,000 barrels of gasoline is manufactured daily in the United States and this amount is handled at least three times before leaving the refinery, the annual saving possible through the universal use of Wiggins Roofs on working gasoline tanks alone amounts to **900,000 barrels x 0.13% x 3 handlings x 365 days** or 197,100 times the saving referred to above.

This amounts to 1,281,150 barrels per year which at only 7c per gallon is worth $3,775,000.

Wiggins Roofs stop the evaporation loss on working tanks or standing storage. Ask for our bulletin "Stopping Evaporation" or let us quote on Wiggins Roofs for your tanks.

CHICAGO BRIDGE AND IRON WORKS

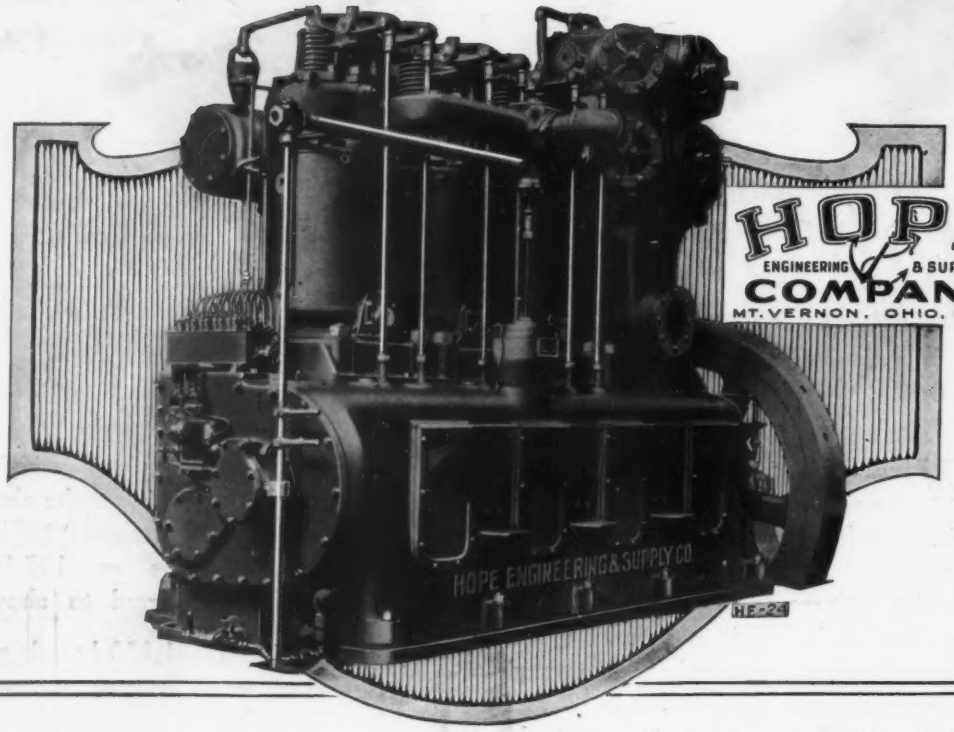
Chicago—2463 Old Colony Bldg.
New York—3102 Hudson Terminal Bldg.
Cleveland—2234 Union Trust Bldg.
Dallas—1655 Dallas National Bank Bldg.
Atlanta—1046 Healey Bldg.
San Francisco—1051 Rialto Bldg.

WIGGINS ROOF

R&NGM6-Gray

Mention Where You Saw the Advertisement

HOPE
VERTICAL
COMPRESSORS



HOPE
ENGINEERING & SUPPLY
COMPANY
MT. VERNON, OHIO, U.S.A.

THEORIES are excellent in their place—but established facts have greater value as a guide. A critical attitude of mind is the engineer's safeguard—but, carried to extremes, it often defeats its own ends.

When the Hope Vertical Gas Compressor made its advent, its radical departure from common practice made it a target for criticism—and dire were the results promised those who dared break what may be called "the horizontal habit."

Today, we need only point to what Hope Vertical Gas Compressors are, are doing, and have done.

The specifications may interest you

HOPE **ENGINEERS & CONTRACTORS IN NATURAL GAS AND OIL** HOPE

Mention Where You Saw the Advertisement

F.O.P.

An Asbestos-fibre Oil-proof SHEET PACKING *developed exclusively for oil industry service.*

NO manufacturer of packings has made as thorough an investigation of the requirements of the modern refinery and gasoline plant as has the United States Rubber Company. There is not a condition from the handling of crude in the pipe line to the various pumps carrying gasoline, kerosene and hot oils, down to hot tar, that is not being packed successfully and economically with "U. S." Packing.

We are particularly proud of the remarkable service given by our F. O. P. ASBESTOS-FIBRE OIL-PROOF SHEET PACKING.

Recommended for flanges on hot oil, cold oil, benzine, naphtha, gasoline, mineral seal oil and high or low pressure, saturated or super-heated steam.

F. O. P. has no equal for high pressure Still Head Gaskets. It will not soften in hot oil *at any temperature*.

Performance records prove it to be the perfect packing for all types of gaskets on gas or oil engines, compressors, or extreme dry heat conditions.

Specify F. O. P. Sheet Packing!

United States Rubber Company

1790 Broadway (US Trade Mark) New York City

Sales Branches:

Tulsa, Okla.
Houston, Texas
Columbus, Ohio
Chicago, Ill.
Pittsburgh, Pa.
New Orleans, La.
Kansas City, Mo.
St. Louis, Mo.
Los Angeles, Cal.
Dallas, Texas
Memphis, Tenn.
New York City

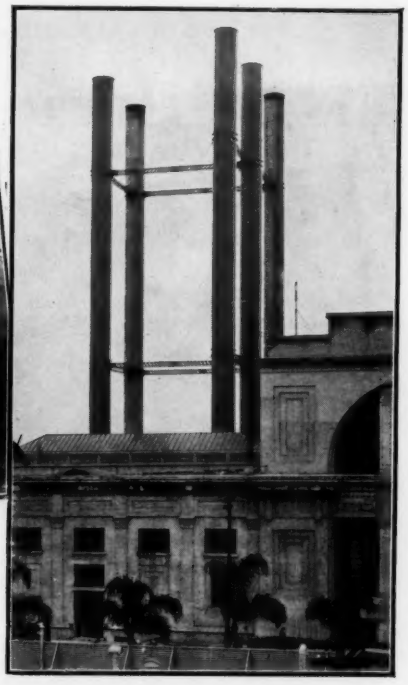
If petroleum could be logged like timber or mined like coal there would be no spasms of over-production Regulation and conservation would be easy But since it is a flowing liquid difficult problems exist

Baffling though they appear, they must and will be faced frankly by the industry itself and solved by it if steady prosperity is to be attained and government regulation is to be avoided

Universal Oil Products Company
Owner of the Dubbs Process
310 South Michigan Ave
Chicago, Illinois

Right: Smoke stack painted with Bitulumin.
San Diego Cons. G. & E. Co.

Lower: Associated Oil Co. Tank Car.



ALUMINUM PAINTS *deflect* HARMFUL SUNRAYS

BITULUMIN'S Sunray Deflection 86% Keeps Tanks and Contents Cooler Minimizing Evaporation

THE rapidly increasing use of Aluminum Paints in general and Bitulumin in particular for protecting a variety of exposed metal surfaces is due to their unusual protective qualities.

Bitulumin successfully resists paint's two worst enemies, sunlight and moisture. It is largely immune to Ultra Violet rays which break down paint surface, allowing moisture to penetrate.

Bitulumin turns away approximately 86% of harmful sunrays thus keeping tanks and contents cooler and minimizing evaporation.

Bitulumin forms a light resisting durable and moisture proof surface. It will outlast the best lead and zinc paints by two to one.

Bitulumin, while widely used for painting oil storage, is equally efficient on tank cars, metal buildings, refinery equipment, still towers, water tanks, bridges, etc.

Bitulumin, put up in double containers to insure fresh mixing, is manufactured by Hill, Hubbell & Company, manufacturers of a special line of paints for the oil industry.

HILL, HUBBELL & COMPANY

Manufacturers of
Highest Grade Oil Industry Paints and Pipe Line Coatings

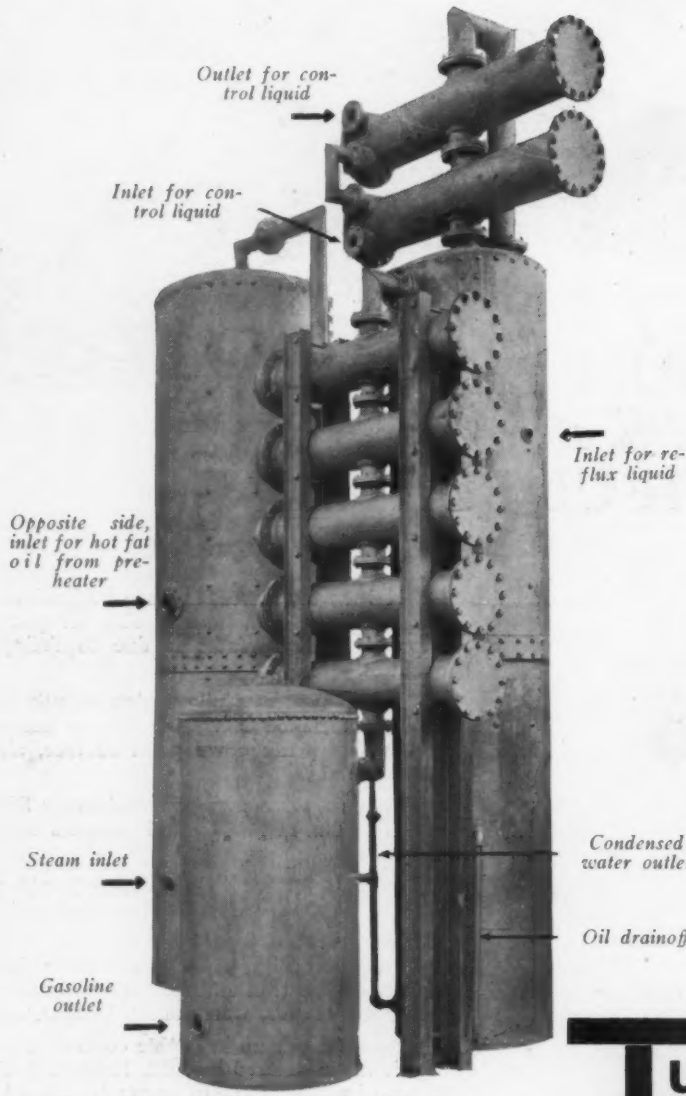
Factories at SAN FRANCISCO and TULSA

District Offices:

331 W. Eleventh St., LOS ANGELES
2412 First Ave. S., SEATTLE
1006 Washington Ave., HOUSTON
51 First St., PORTLAND
15 Moore St., NEW YORK CITY
600 E. Lombard St., BALTIMORE

Mention Where You Saw the Advertisement

Distillation and Condensing Unit



TULSA TYPE

TULSA BOILER & MACHINERY COMPANY

P. O. Box 1963 Tulsa, Oklahoma

Mention Where You Saw the Advertisement

Oil-immersed, flame-proof starters for squirrel cage, slip-ring and synchronous motors

The Type ZO Across-the-line Switch

Low Voltage Automatic Compensator

EC&M Automatic Starters for alternating current motors are being supplied for motors ranging from ¼ HP to 500 HP, and for low and high voltages. Designed to make them flame-proof to suit such conditions as exist in the oil industry, there is no chance of an open electric arc which might cause a disastrous fire.

Oil company officials and engineers who are interested in flame-proof, automatic control equipment for pipe line pumping duty, for air lift and casing-head gasoline compressor installations, are requested to write us for descriptive literature.

High Voltage Automatic Compensator

Ask for Bulletins 1048, 1042-F and 1047

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

NEW YORK-50 CHURCH ST. CHICAGO-CONWAY BLDG. DETROIT-DIME BANK BLDG. BIRMINGHAM-BROWN-MARX BLDG. CINCINNATI-1ST NATIONAL BANK BLDG. MONTREAL-DRUMMOND BLDG. LOS ANGELES-AMERICAN BANK BLDG. SALT LAKE CITY-228 W. SO. TEMPLE TORONTO-REFORD BLDG. PHILADELPHIA-WITHERSPOON BLDG. PITTSBURGH-OLIVER BLDG. SAN FRANCISCO-CALL BUILDING SEATTLE-570 COLMAN BLDG. TULSA-217 E. ARCHER ST.

Mention Where You Saw the Advertisement

CAPACITY—

AND CLOSE REGULATION

A FOUR INCH BUCK CASING HEAD REGULATOR

Has passed over 1,200,000 Cu. Ft. of Gas in 24 hours, from 5-points intake to 7-points discharge—and maintained intake vacuum within 2 ounces of the 5-point setting.

BUCK

CASING HEAD REGULATORS

BUCK CASING HEAD REGULATORS are Good News for the Gas Plant Superintendent. They "go out and get the gas." Their great capacity, exceedingly close regulation, low operation and maintenance costs, open the way to new economies of Regulator purchase and installation. For instance, Four Inch BUCK Regulators are being used where 6-inch "ordinary" regulators would otherwise be required, because their great capacity handles the flow. Their close regulation and great capacity result from the use of the Buck Sleeve Valve principle.

BUCK REGULATORS are sturdy, simple and strong. Built to deliver the goods in actual field use in the most complete and satisfactory way. Easy to install and require the minimum of attention in the field.

G-B MFG. CO. KANSAS CITY, MO.

BUCK OIL CONSERVATION EQUIPMENT

Type A Sensitive Regulators
Casing Head Regulators
Liquid Level Controllers
Tank Valves and Equipment
Oil and Gas Separators
Oil Field Supplies

BELTING
Rubber Canvas
Leather Cotton
Balata

HOSE
Air Fire
Oil Steam
Water

PACKING
Asbestos Hemp
Flax Rubber
Leather

GASKETS
Rubber Asbestos
Leather Fiber

WASTE
White Colored
Wool

MISC'L
Matting Drills
Pulleys Picks
Shovels

No Dash Pot—No Chatter

There are no dash pots on BUCK REGULATORS. The Sleeve Valve principle aids in eliminating chatter and makes dash pots unnecessary. Thus there is no danger of freezing of water in dash pots,—the sensitivity of the Regulator is in no way interfered with—and there is no time nor labor wasted in keeping dash pots filled and in working order.

Graduated Scale Beams Make Easy, Accurate Setting

BUCK CASING HEAD REGULATOR BEAMS are graduated,—on one side for inches mercury vacuum and on the other, for pounds pressure. This makes easy, accurate setting in the field. Beams are reversible so the Regulator is a Vacuum or Back Pressure Regulator at will.

Locked Beam Weights—Keys Furnished

The Counterpoise Weights are locked on the Scale Beam by a set screw turned with a key supplied with each Regulator. Keys may be issued by Superintendents only to Line Walkers and other authorized persons. This feature eliminates indiscriminate tampering with Vacuum or pressure settings

Long Wear Diaphragms

We make our own Diaphragms. We make them of a special tannage of selected No. 1 chrome leather, treated by a process that gives utmost flexibility without sacrifice of strength, and renders them impervious to gasoline. These Diaphragms have operated in the field for long periods immersed in gasoline and as yet show no signs of weakening.

Weather Shields

The working parts of BUCK CASING HEAD REGULATORS—fulcrums, valve stems, etc., are protected by a strong, sturdy iron hood. This not only protects the working parts from snow, sleet or rain, but also from accidental injury. This shield or hood is so designed that it in no way interferes with the free working of the Regulator.

Get Our Bulletin No. 2

We will gladly mail you complete descriptions, illustrations, cross section diagrams and capacity tables of BUCK CASING HEAD REGULATORS. Better yet, get acquainted with our representative and do as others are doing—put BUCK REGULATORS to work on your own properties.

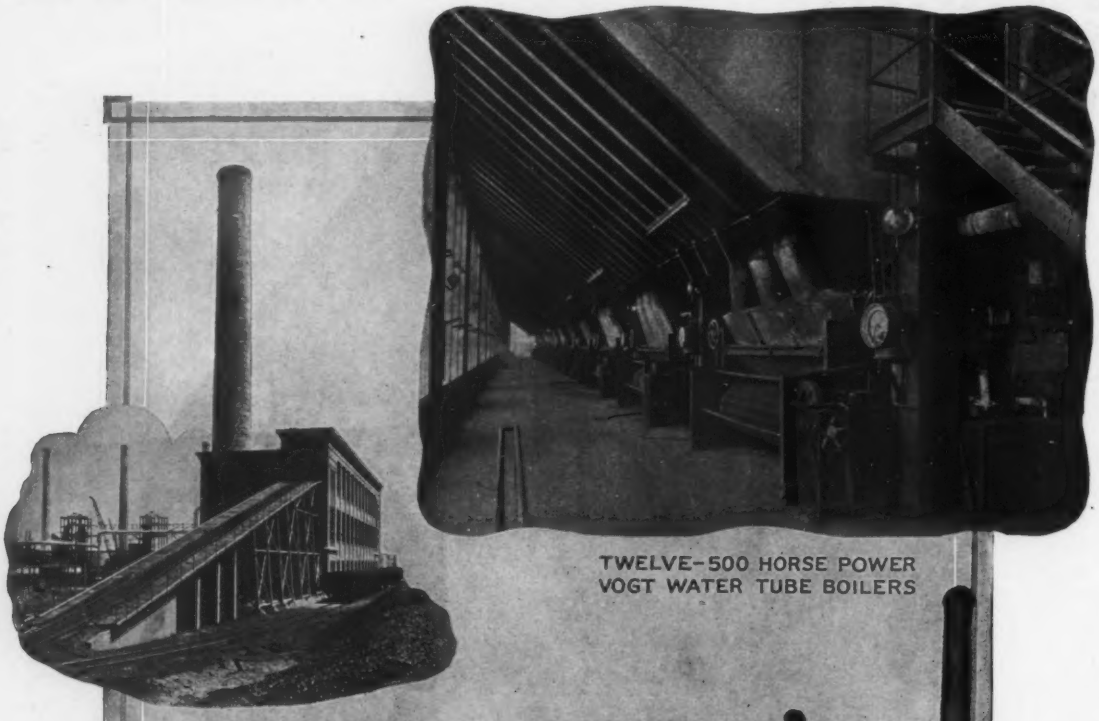
Gustin-Bacon Mfg. Co.

Vacuum Control Division

KANSAS CITY, MO.

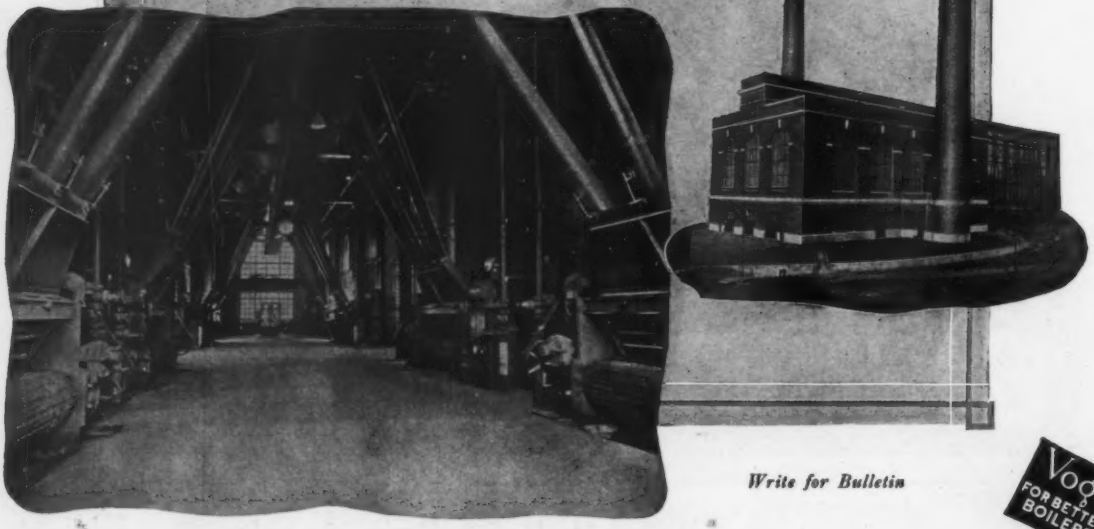
Chaplin-Fulton Products
FULTON LOW PRESSURE REGULATOR
VIGILANT LIQUID LEVEL REGULATOR
FULTON GAS FUEL BOILER GOVERNOR
FULTON DUPLEX SENSITIVE REGULATOR
INLET
OUTLET
FULTON HIGH PRESSURE OR REDUCING REGULATOR
Sales and Service
WESTCOTT & GREIS
MEASUREMENT AND CONTROL
Dallas
TULSA
Los Angeles

Vogt Water Tube Boilers are installed in most Modern Power Plants. - - -



TWELVE-500 HORSE POWER VOGT WATER TUBE BOILERS

AN INSTALLATION OF EIGHT-755 HORSE POWER VOGT WATER TUBE BOILERS



Write for Bulletin

HENRY VOGT MACHINE CO., Inc.

LOUISVILLE, KY.

New York Chicago Philadelphia Cleveland Dallas

Manufacturers of Oil Refinery Equipment, Drop Forged Steel Valves and Fittings, Water Tube and Horizontal Return Tubular Boilers, Ice Making and Refrigerating Machinery.

Experience, Economy and Time
Three Vital Factors in the Western Line

The Western Line
Bubble Tower Castings

We are especially equipped and thoroughly experienced in the manufacture of castings for Bubble Towers.

For a quarter of a century we have specialized in steel and structural work, and we are especially equipped to manufacture and supply:

Structural steel and iron.
Plate and sheet work.
Smoke stacks.
Gray iron castings.
Tank car repair parts.
Dome covers.
Outlet caps.
Raw material from warehouse shipments.

Prompt Delivery

Because of our location in the Mid-Continent field and our experience and complete facilities, we can probably make shipments in a shorter length of time than you have enjoyed before.

Freight Rates.

Because of our central location, refiners in the Mid-Continent field will effect a saving in freight rates which is no small item.

WRITE FOR CATALOG

FOR twenty-five years The Western Iron & Foundry Company have been serving the refiners of the country through the manufacture of special refinery equipment. We are graduates of the school of experience and we have taken a post-graduate course in practical application. This experience does not add one penny to the cost, but it adds a lot to the value of our products.

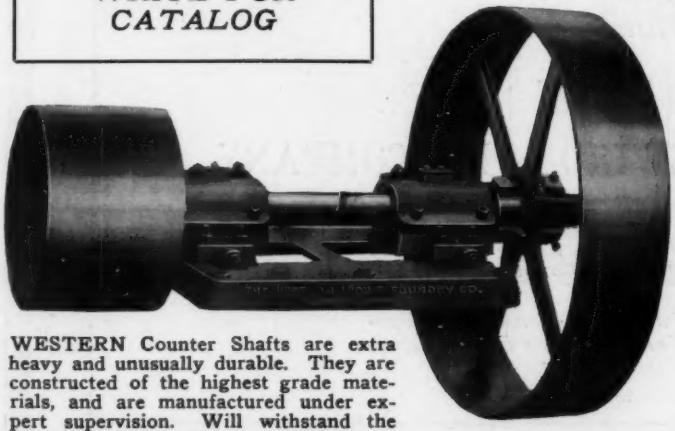
One result of experience is economy, constant practice of doing the same thing over well adds to the quality and reduces manufacturing costs. Another economical Western feature is our central location, and in our heavy products this is no small item for your consideration.

Prompt deliveries complete the three vital factors in Western service. Our central location reduces delivery time through short hauls. Our experience has taught us short cuts to perfection. The completeness of our physical equipment means a saving and time for you between the placing of an order with us and our delivery of the completed work to you.

Purchasing agents and executives will find it greatly to their advantage to consult with us before placing orders in our lines. A responsible representative of this Company will be glad to consult with you either in your office or ours.

Quotations promptly given.

WESTERN RIVER Clamps fit flush and tight with pipe. Are smooth clean castings. They take the strain off the weld or coupling and prevent joints from breaking. Prompt shipment on standard sizes for pipe up to 16 inches.



WESTERN Counter Shafts are extra heavy and unusually durable. They are constructed of the highest grade materials, and are manufactured under expert supervision. Will withstand the severest strains. Carried in stock in all standard size pulleys and shafts; with end bearings, if preferred.

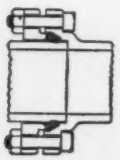
The Western Iron & Foundry Company

WICHITA, KANSAS

Established 1902

WRITE FOR CATALOG

SIMPLEX CAST IRON CONDENSER PIPING



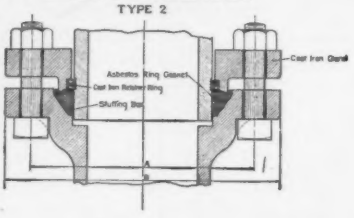
"ONE FLANGE IS LOOSE"

Settles the Rust Question

Progressive refineries now secure the durability of cast iron pipe in their condenser coils without the disadvantage of standard flanged pipe construction. Our Simplex joint, using a triangular shaped, endless asbestos gasket, is the secret. It is fully described and illustrated in our Catalog No. 55. Your copy is ready to be mailed upon receipt of your request.

Do you know why cast iron resists corrosion so much more than other ferrous metals? Our Bulletin No. 44 explains it.

CROSS SECTION OF ASSEMBLED JOINT
SIMPLEX CONDENSER PIPING
TYPE 2



Dimensions A and B are American Standard for 125 lbs. pressure

AREA PER LINEAR FOOT

SIZE	CLASS	INSIDE SURFACE	OUTSIDE SURFACE
3"	AB	.67836	.96175
	CD		.96472
4"	A	.16472	.17490
	B&D		.13100
6"	A	.13708	.18850
	B&D		.19326
8"	AB	.20944	.23600
	CD		.24400
10"	AB	.26200	.32100
	CD		.32900
12"	AB	.33418	.34800
	CD	-	.35600

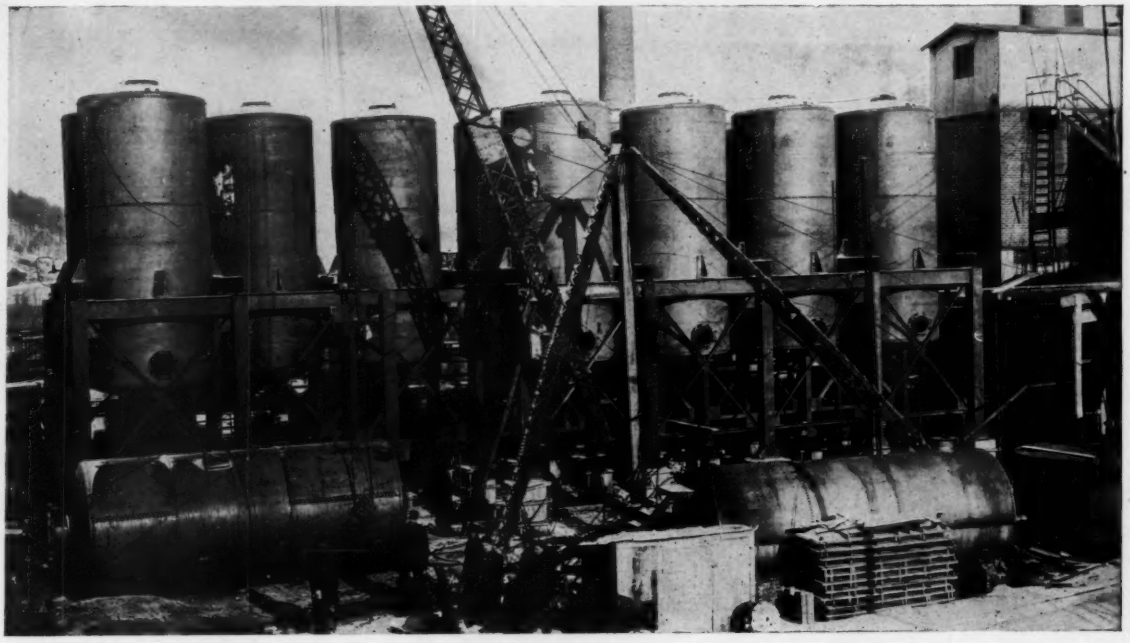
Write for Simplex Condenser Catalog Number 55

AMERICAN CAST IRON PIPE COMPANY

General Offices and Foundry: Birmingham, Ala.

Branches at
Dallas, Kansas City, San Francisco, Los Angeles, Chicago, New York,

Write Also for information on Our Prepared Joint Cast Iron Pipe for Oil Lines



Hammond Filters with Fulton Patented Heads with Removable Non-Corrosive Monel Metal Screen. A Labor Saver doing away with old fashioned methods. Made in Diameters 5 to 10 feet and heights 10 x 30 feet. Names of users on request.

Our Bulletin No. 300 describes these Filters.

Our Bulletin No. 200 covers storage tanks from 300 to 80,000 barrels, and Bulletin No. 100R covers Horizontal Tanks from 1600 to 24,000 gallons. We make a specialty of furnishing steel tanks knocked down for domestic or export.

Erection men always available.

HAMMOND IRON WORKS

WARREN, PA.

Manufacturers and Exporters of Steel Tanks and Steel Plate Construction

(New York Office: 17 Battery Place—Telephone 0060)

These Distributors stock ADAMANT *in 100 lb., 250 lb., and 400 lb. containers. Distributors are listed under state and city, with states arranged alphabetically.*

Alabama, Birmingham,
Young and Vann Supply Company
California, Los Angeles,
Industrial Supply Co.
California, San Francisco,
W. E. Mushet Co
Colorado, Denver,
H. W. Thompson
Connecticut, New Britain,
Rackliffe Bros. Co., Inc.
Connecticut, New Haven,
The Warner-Miller Co.
Illinois, Chicago,
Wm. E. Dee Company
Indiana, Fort Wayne,
Coan Equipment Co.
Indiana, Indianapolis,
Indianapolis Belting & Supply Co.
Iowa, Des Moines,
The Walrodh Supply Company
Kentucky, Louisville,
E. D. Morton & Company, Inc.
Kentucky, Paducah,
Henry A. Petter Supply Company
Louisiana, New Orleans,
Woodward Wight & Company, Ltd.
Louisiana, Shreveport,
Woodward Wight & Company, Ltd.
Maryland, Baltimore,
King's Coal and Supply Company, Inc.
Massachusetts, Boston,
Waldo Bros. and Bond Company
Massachusetts, Springfield,
Oscar F. Carlson
Massachusetts, Worcester,
Waldo Bros. and Bond Company
Michigan, Detroit,
H. D. Edwards & Co.
Minnesota, Duluth,
Duluth Builders Supply Co.
Minnesota, Minneapolis,
Northern Machinery & Supply Co.
Missouri, Kansas City,
Union Material & Supply Co.
Missouri, St. Louis,
Reed Railway Supply Co.
Nebraska, Omaha,
American Machinery & Supply Co.
New York, Buffalo,
The Curtis Supply Co., Inc.
New York, Mohawk,
The American Hard Wall Plaster Co.
New York, New York,
C. C. Phillips, 110 W. 34th St.
New York, Rochester,
American Clay & Cement Corp.
Wm. Summerhays & Son
New York, Rome,
The American Hard Wall Plaster Co.
New York, Syracuse,
The Paragon Plaster Company
New York, Utica,
The American Hard Wall Plaster Co.
Ohio, Cincinnati,
The Wm. T. Johnston Co.
Ohio, Cleveland,
The Cleveland Tool & Supply Co.
Ohio, Columbus,
The Westwater Supply Co.
Ohio, Dayton,
The Klinger-Dills Co.
Ohio, Toledo,
The Toledo Builders Supply Co.
Oklahoma, Tulsa,
Standard Asbestos & Cork Company
Oregon, Portland,
The M. L. Kline Co.
Pennsylvania, Aspinwall,
The Gas Combustion Company
Pennsylvania, Erie,
O. C. Thayer and Son
Pennsylvania, Pittsburgh,
The Gas Combustion Company
Post Office Box No. 1753
Pennsylvania, Reading,
Reading Foundry and Supply Co.
Rhode Island, Providence,
B. & H. Supply Co., Inc.
South Carolina, Columbia
Columbia Supply Company
South Carolina, Spartanburg
Spartanburg Mill Supply Co
Tennessee, Memphis,
Reed and Duecker
Texas, Beaumont,
Norvell-Wilder Hardware Company
Texas, Corpus Christi,
San Antonio Machine & Supply Co.
Texas, Dallas,
The Murray Company
Texas, El Paso,
Geo. S. Thomsen Company
Texas, Houston,
Norvell-Wilder Hardware Company
Texas, San Antonio,
San Antonio Machine & Supply Co.
Texas, Waco,
San Antonio Machine & Supply Co.
Virginia, Norfolk,
Empire Machinery & Supply Corp.
Washington, Seattle,
Cragin & Co.
Washington, Spokane,
Consolidated Supply Company
West Virginia, Charleston,
South Side Foundry & Machine Works
Wisconsin, Milwaukee,
Tewe Lime & Cement Co.
Wisconsin, Superior,
The Speakes Company

Canadian Distributors

British Columbia, Vancouver,
B. C. Equipment Company, Ltd.
Manitoba, Winnipeg,
Walter Heiress & Company, Ltd.
Ontario, Hamilton,
Thomson-Gordon, Ltd.
Ontario, Port Arthur,
Wells & Emmerson
Ontario, Toronto,
J. H. Morrison
Quebec, Montreal,
Alex. Bremner, Ltd.

$25.00
Buys The ADAMANT Gun

Why Spend More for Heavier, Bulky Equipment To Do the Same Work?

WHEN you buy The ADAMANT Gun, you own it outright—no strings attached. With it, you can "face" or coat your still settings or boiler furnace brickwork with highly refractory, protective surfacing of the ADAMANT-ADACHROME mix, which provides high resistance to clinker adhesion, slags and to sulphur or other fuel impurities that cause fluxing, melting or washing-out of brick.

With The ADAMANT Gun applying the ADAMANT-ADACHROME mixture, you can quickly fill in burned-out sections and depressions. You can close and seal all open joints, brick pores, cracks and crevices. You can keep your settings in a condition closely approximating their newly-built state. Think of the results in longer refractory service and lowered maintenance cost! Although The ADAMANT Gun weighs less than 4 pounds and is so compact that it fits in the average brief-case, it is just as efficient as any bulky, heavy and high-priced equipment you can buy to do the same work.

Furthermore, The ADAMANT Gun has no tanks to fill or clean; no pistons, no floats, nor long hose lines through which the mixture must pass. Briefly, The ADAMANT Gun is ideal for refractory maintenance in the refinery.

Write for copies of the new booklet on The ADAMANT Gun and the ADAMANT-ADACHROME mixtures.

Mixtures of ADAMANT-ADACHROME can be used for laying up brick as well as for applying surfacings with The ADAMANT Gun. Write for the booklet of ADAMANT-ADACHROME mixtures.

BOTFIELD REFRACTORIES CO,
783 S. Swanson St., Philadelphia, Pa.

For A Long Furnace Run, Use The ADAMANT *Gun*

ADAMANT
FIRE BRICK CEMENT

Whenever you use a fire brick, use ADAMANT, *the original high temperature cement*

can you utilize High Vacuum?

It is as simple as this: The velocity of steam jets exhausts air, vapor or other gases, creating vacuum in any closed vessel or system. By multi-staging, as high a vacuum as wanted can be created. No moving parts, no operating attention, no lubrication, no foundations, etc.

The great advantages of distillation under high vacuum are being demonstrated daily in refineries distilling lubricating oil. Under high vacuum a better quality of oil can be produced at less cost, as compared with low vacuum operation. High vacuum distillation requires less heat, and produces oil that requires little or no further treatment.

✦ ✦ ✦

Very high vacuua are being obtained both economically and very simply, in many of the largest and most important oil refineries, by means of Elliott Ejectors. Complete distillation equipment including oil vapor condensers, oil heat exchangers, partial condensers, etc., may be furnished.

✦ ✦ ✦

Let us co-operate with your engineers in putting the advantages of high vacuum operation to work in your refinery.

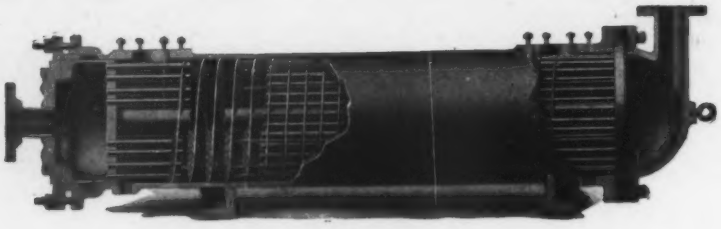
Elliott Power Equipment includes prime movers, generators and electrical machinery, condensers, deaerators, centrifugal blowers, and accessory equipment.

ELLIOTT COMPANY
PITTSBURGH, PA.
General Offices **JEANNETTE, PA.**
Sales Offices in principal cities

C-307

Mention Where You Saw the Advertisement

Uses any raw water supply to cool engine jacket water



The G-R Multiwhirl Jacket Water Cooler

By eliminating the possibility of scale formation in the engine jackets

Will increase the operating efficiency and reduce the maintenance charges of oil and gas engines and compressors by preventing overheating troubles and assuring proper cylinder cooling effect.

With the Multiwhirl Jacket Water Cooler a small amount of distilled water can be circulated continuously through the engine jackets and cooled by any kind of raw water in passing through the Cooler. The unit is compact because of its high rate of heat transfer, is easily inspected and cleaned, and has several special advantages of construction that assure durability and trouble-free operation. Thousands are in service in every type of liquid cooling service.

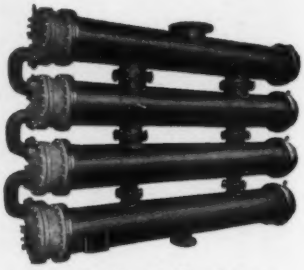
Send for Complete Information

THE GRISCOM-RUSSELL COMPANY
285 Madison Avenue, New York

Philadephia	Chicago	St. Louis	San Francisco
Boston	Cleveland	Kansas City	Los Angeles
Rochester	Detroit	Charlotte	Seattle
Pittsburgh	Milwaukee	New Orleans	Denver
Columbus	Indianapolis	Houston	Salt Lake City
Atlanta	Minneapolis	Dallas	Tulsa

For Canada: Riley Engineering and Supply Co., Ltd., Toronto

Note these other G-R Units for lower refining costs



G-R Sectional Condenser

For condensing hydrocarbon vapors and other vapors

Can be used either as a standard or reflux condenser. The sectional arrangement permits using as a condenser and heat exchanger in one set or to obtain a different cut from each section.

Mineral Seal Oil Heat Exchangers

A compact, twin exchanger with strict counter-current flow to promote maximum rate of heat interchange.

G-R Vaneflo Gas Cooler

For cooling casinghead or natural gas. Can be used an inter-, after-, or precooler in absorption and compression type natural gasoline plants. Has low pressure loss and exceptional efficiency.

G-R Gasoline Condenser

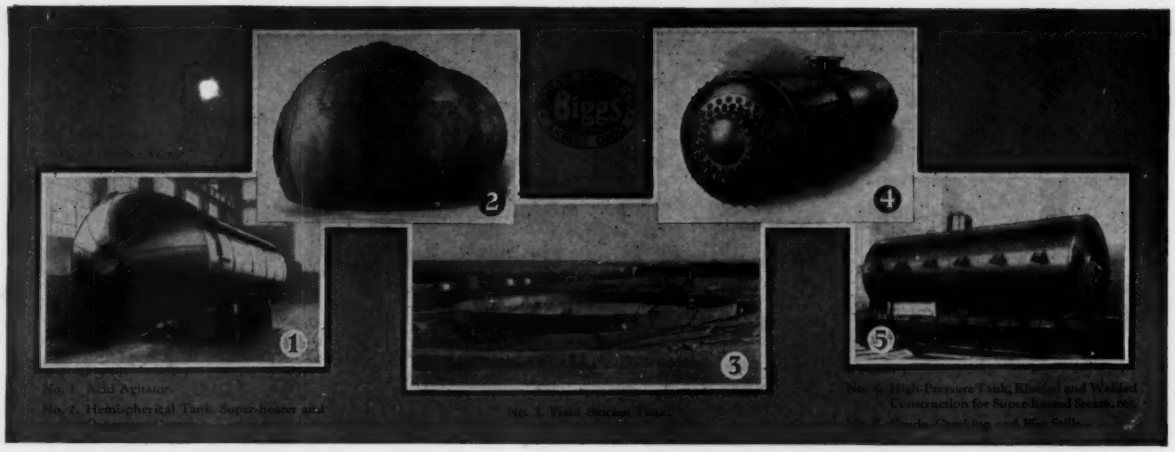
For condensing natural gasoline vapors in casinghead gasoline plants.

Can also be used as a knockout box or fractionating tower control section with particularly close control of the end points.

G-R Twin Heat Exchanger

For the efficient interchange of heat between crude oil feed stock and still bottoms, cold water and hot oil, etc.

Griscom-Russell Heat Transfer Apparatus



No. 1. Acid Agitator.
No. 2. Hemi-spherical Tank, Super-heater and
No. 3. Fixed Storage Tank.
No. 4. High Pressure Tank, Riveted and Welded Construction for Super-heated Steam, etc.

Let Biggs Figure on *All* Your Heavy Plate Work

The cut above hints at the mammoth scale upon which Biggs is **completely** equipped to serve the oil industry. The list to the right suggests the wide range of Biggs Products.

Yet large scale and wide range are matched by Biggs accuracy. Biggs ideals, maintained for the past 40 years, actually insure a degree of precision reminiscent of watch making. The whole Biggs organization, from blue print to final inspection, is geared to thousandth-of-an-inch accuracy.

"Built by Biggs" means "Made Right — Always Tight." We should be pleased to quote you on your present requirements —especially on heavy duty steel plate work up to 1½" thickness.

Manufacturers of

- Pressure Stills for Cracking Process
- Fractionating Towers
- Dephlegmating Towers
- Bubble Towers
- Heat Exchangers
- Agitators
- Steam Stills
- Crude Stills
- Condenser Boxes
- Run Down Tanks
- Blending Tanks
- Hemispherical Tanks
- Blow Cases
- Acid Tanks
- Compounding Kettles
- Storage Tanks to 80,000 Barrels
- Smoke Stacks and Breechings, etc.

You will enjoy glancing through "What Biggs Does, and How." It's a quick, interesting sketch of Biggs methods and service. Use the coupon.

THE BIGGS BOILER WORKS COMPANY

General Offices and Works: Akron 25 Ohio
Eastern Sales Office: 300 Madison Ave., New York City
Chicago Office: 35 S. Dearborn St.

Please attach to your letterhead

THE BIGGS BOILER WORKS COMPANY
Akron 25, Ohio
Send "What Biggs Does and How" to

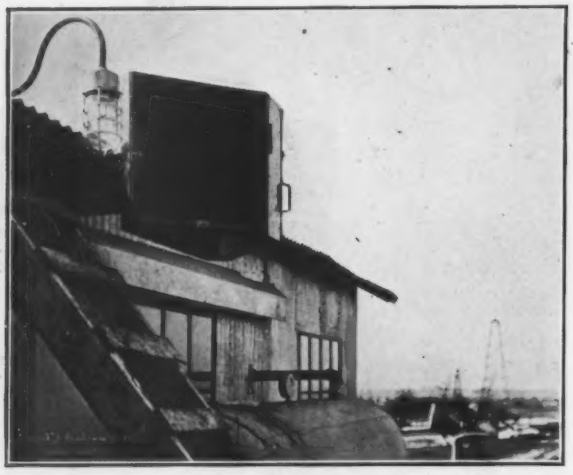
NAME.....
We are particularly interested in
Firm Name .....
Addrses .....
.....

The Biggs Boiler Works Co. Akron Ohio Est. 1857 — TRADE MARK REGISTERED

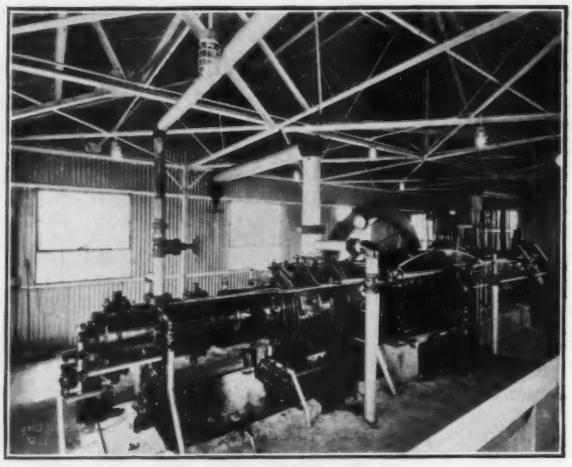
TANKS AND GENERAL
STEEL PLATE WORK
for the Oil Industry

Mention Where You Saw the Advertisement

CLEAN AIR LENGTHENS COMPRESSOR'S LIFE



Reed Air Filter installed at the Pioneer Gasoline Company Plant, Kellyville, Oklahoma.



The 170 H. P. Worthington Compressor at the Pioneer Plant, served by Reed Air Filter

Dust laden air, carried to your compressors, creates wear that shortens the life of your equipment.

Reed Air is Clean Air . . . more than 97% of the dust, grit and dirt removed . . . and means long life with resulting saving of shut-down time and repair cost.

In the Oil Industry producers and refiners are turning almost daily to the Reed Air Filter as a protective measure against compressor depreciation.

Every shut down is costly in time lost as well as in repair expense. Reed Air Filters are being installed as an insurance against these costly delays and repair costs. The fact that the demand is steadily increasing is conclusive evidence of the economic value of Reed Air Filters.

Ask for illustrated literature.

Reed Air

TRADE MARK

REED AIR FILTER CO., INC., LOUISVILLE, KY.

Texas Offices:
924 Post Dispatch Bldg., Houston, Texas
1402 Fort Worth National Bank Bldg. Fort Worth, Texas

Distributed to the Oil Industry by

SMITH SEPARATOR COMPANY

Tulsa Okla.

California Office:
2039 East 38th St., Los Angeles, Calif.

Louisiana Office:
405 Forest Ave., Shreveport, La.

Mention Where You Saw the Advertisement

Vol. 6, No. 6

JUNE, 1927

The REFINER

AND NATURAL GASOLINE MANUFACTURER

Edited Monthly at Tulsa, Oklahoma

GRADY TRIPLETT, *Editor*

TABLE OF CONTENTS

NATURAL GASOLINE RESEARCH PROGRAM TO BE CONTINUED 51
By Grady Triplett

REFINERY CAPACITY SHIFTING TO INTEGRATED COMPANIES 53
By George Reid

EXPERIMENTAL PLANTS PROVE VALUE IN REFINERY PRACTICE 55

DEVELOPMENT OF NATURAL GASOLINE INDUSTRY IN CALIFORNIA 58

HOW ONE CONCERN INSULATED ITS BRINE AND CHILLED OIL LINES AND TANKS 62
By H. L. Kauffman

WEEKLY INSPECTIONS REDUCE SAFETY HAZARDS AT BAYTOWN 66
By George Reid

NATURAL GASOLINE SUPPLY MEN'S ASSOCIATION FORMED 68

THE UNIT IDEA AS APPLIED TO THE NATURAL GASOLINE PLANT 70
By S. S. Smith

GASOLINE PLANT LUBRICATION 74
By E. R. Lederer, O. S. Wyatt and F. R. Staley

WATER TREATMENT IN NATURAL GASOLINE MANUFACTURE 80
By F. B. Good

VACUUM AT BURKBURNETT 84
By M. V. Enright

ANNUAL ADDRESS OF THE PRESIDENT 86
By E. L. Peck

SMALL SCALE CONTINUOUS STILLS FOR CRUDE OIL ELEVATION 88
By R. C. Beckstrom and C. F. Barb

HYDROCARBONS OCCURRING IN COMMERCIAL GASOLINE 92
By George Reid

IMPORTANT CONSIDERATION IN DESIGN AND CONSTRUCTION OF ABSORPTIION PLANT 96
By Paul Barton

DESULPHURIZING ACTION OF SILICA-GEL 100
By H. I. Waterman and M. J. Van Tussenbrock

NEW METHOD FOR FLASH TEST 104
By V. T. Downey

Published Monthly by GULF PUBLISHING COMPANY
Copyrighted, 1927

R. L. DUDLEY, *President*
A. L. BURNS, *General Manager*
SPENCER W. ROBINSON, *Editorial Director*
J. KENT RIDLEY, *Managing Editor*

Editorial Office: 214-218 Atco Building, Tulsa, Oklahoma
Office of Publication: 1716 Dallas Avenue, Houston, Texas

NEW YORK: Room 832. 250 Park Avenue, R. P. Swinsky, Manager. *PITTSBURGH*: 510 Park Bldg., W. W. Pigue, Manager. *CHICAGO*: 476 First National Bank Bldg., O. R. Waller, Manager. *LOS ANGELES*: 1201 Haas Bldg., Wm. V. Gross, Manager. *TULSA*: 214-218 Atco Bldg., J. F. Carter, Jr., Manager. *FORT WORTH*: 203 W. T. Waggoner Bldg., H. H. King, Manager. Single copies 20 cents. Domestic Subscription price, $1.00 a year. Foreign Subscription price $1.50 a year. Advertising rates upon application.

There's only ONE

KEROTEST

Series 150—150 lbs. pressure at 750°

Series 250—250 lbs. pressure at 750°

Series 300—300 lbs. pressure at 750°

Series 400—400 lbs. pressure at 750°

Series 600—600 lbs. pressure at 750°

Series 900—900 lbs. pressure at 750°

Tough, close-grained ilmenite electric steel is used in all Kerotest Valves for refinery service where high pressures and high temperatures prevail.

The vital valve parts of Kerotests, where the wear and tear is the greatest, are trimmed with the best non-corrosive metals obtainable, including monel, nickel, bronze, chrome nickel or stainless.

This construction combined with several exclusive features of design, makes Kerotests the logical choice of every refinery engineer.

The Kerotest Folder gives you the detailed facts—*Write for it.*

KEROTEST MANUFACTURING CO.
2525 LIBERTY AVENUE
PITTSBURGH PENNA.

KEROTEST

REGISTERED U.S. PAT OFF.

Mention Where You Saw the Advertisement

Why Not Sell and Complain Less?

THE petroleum industry is now beset by more talk than at any other period in its history. The cry is for a remedy that will convert loss into profit.

The branch of the industry bearing the brunt of loss in the past six months is refining. It can be said to the credit of the men responsible for refinery operation that they have been responsible for less talk in this period than the men of any other division of the industry.

There have been so many conferences, so many resolutions, so many committee sessions on what may be termed "shut down" that an accurate guess of their number is not advisable. The greater Seminole area is the cause of most of the talk and most of the resolutions have mentioned it.

Some form of a "shut down" has been imposed on it with regularity. So far the result of so-called "curtailment" has been increased output.

A few men have declined to take any part in these efforts to bring about some sort of agreement between a score of men and concerns, each having individual reasons for pursuing a distince policy. These men have said nothing and refuse to make statements for print. They consider remedy through agreement and "shut down" as little short of comedy.

Five years ago the petroleum industry was informed that the known reserves of petroleum indicated a supply good for seven years in the United States. Thereafter the petroleum industry began to do itself harm by spreading propaganda under the banner of "what will we do when crude oil is gone."

Now the industry finds itself with more crude oil than it can sell at a profit. The condition is a ludicrous climax to the talk that followed the publication of figures on petroleum reserves.

To some extent the petroleum industry is now paying the penalty of the words that were spilled a few years back over the impending depletion of crude oil reserves. It would be interesting to know how many industries were scared away from converting furnaces from coal to oil by the depletion talk.

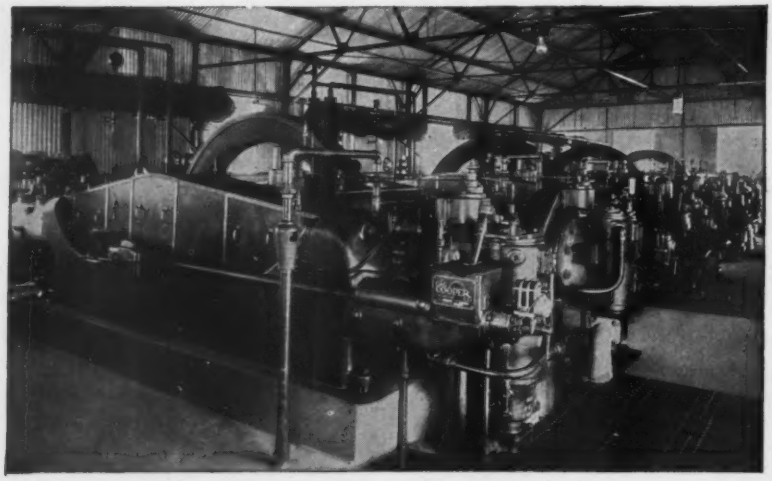
There is one sure way to cure the disease of over-production. It will not bring sudden relief. But it will bring slow and permanent improvement. Another word combination for over-production is under-consumption.

Refiners have it in their power to administer the remedy. It consists of introducing petroleum products where some other heat medium is now used. It means selling.

The view point of the petroleum industry needs to be shifted. The industry needs to take stock of itself and realize that it has plenty of raw material. Instead of warning possible new customers of a "shortage" it should coax them by assurance of plenteous supplies.

By that the ratio of increase in petroleum consumption may be accelerated. By whatever amount this is done, permanent relief will come to each branch of the petroleum industry and the effect will be permanent.

Grady Tribbett



If There Is a Better Time to Install Coopers—

It is when oil prices are low and margins of profit are narrow. It is then that the characteristics of Cooper four-cycle gas engine driven compressors are appreciated most. It is a fact that a Cooper, everything considered, will produce oil cheaper with an air or gas lift or cut the production costs in a gasoline plant.

Cooper engines and compressors always make their staunchest friends when their lower operating costs can mean the difference between a profit or a loss. They are built in standard sizes from 45 to 1500 B.H.P.

THE C. & G. COOPER COMPANY, Mt. Vernon, Ohio

1605 Kirby Bldg., Dallas 604 Kennedy Bldg., Tulsa

649 S. Olive St., Los Angeles

The installation above shows four Cooper 170 B.H.P. gas engines driving compressors for gas lift in Independent Oil & Gas Company, Seminole plant.

Natural Gasoline Research Program To Be Continued

Sixth annual convention occasion for consideration of problems within the industry

By GRADY TRIPLETT

TULSA.—The research and educational program of the Association of Natural Gasoline Manufacturers is to be carried through another year. This decision by the board of directors, following a review of accomplishments of the past year, was perhaps the outstanding decision of the annual convention here May 24, 25 and 26.

Dr. G. G. Brown of the University of Michigan will carry on the work, begun a year ago by him and Dr. E. H. Leslie of the same institution.

The last day of the convention was given over to the work of the research and educational effort. Dr. Brown reviewed the accomplishments of the first year and dealt with possibilities for the coming year. Meeting later with the directors, he outlined in detail the possibilities of the next year. He will devote the greater part of his time to the general subject of vapor pressure, as well as complete some details of the work begun last year.

Entertainment Different

The cost of the work for the coming year was estimated. The directors then gave assurance that funds would be provided for carrying out the effort. The second year of research will begin July 1.

The annual convention was devoted to discussions of plant problems and other phases of the business of manufacturing and selling gasoline. Frequently the existing condition of low prices came out in discussions. The common opinion, however, was that the natural gasoline business will recover along with the remainder of the petroleum industry.

One departure for the convention this year was that of entertainment. Other than the annual banquet, entertainment was undertaken by associate members, who later formed the Natural Gasoline Supply Men's Association. The outstanding entertainment feature was a smoker and cabaret performance, the night of May 24. Reservations were made for 400 and all places were taken by the time the entertainment numbers were begun.

This affair was without speeches and formality. A meal, orchestra music, singing and dancing over a four-hour period served to give association members the best entertainment of the several conventions the association has had.

The annual banquet, the second night, was a brilliant affair. Glenn Condon of the Skelly Oil Company took care of the toastmaster place with the bearing of a circus ring master. The principal speaker was Josh Lee of the public speaking department of the University of Oklahoma, Norman. His subject, "The Pot of Gold at the End of the Rainbow," gave him opportunity to gather many loose ends of humor and serve them as cloth of his own designing.

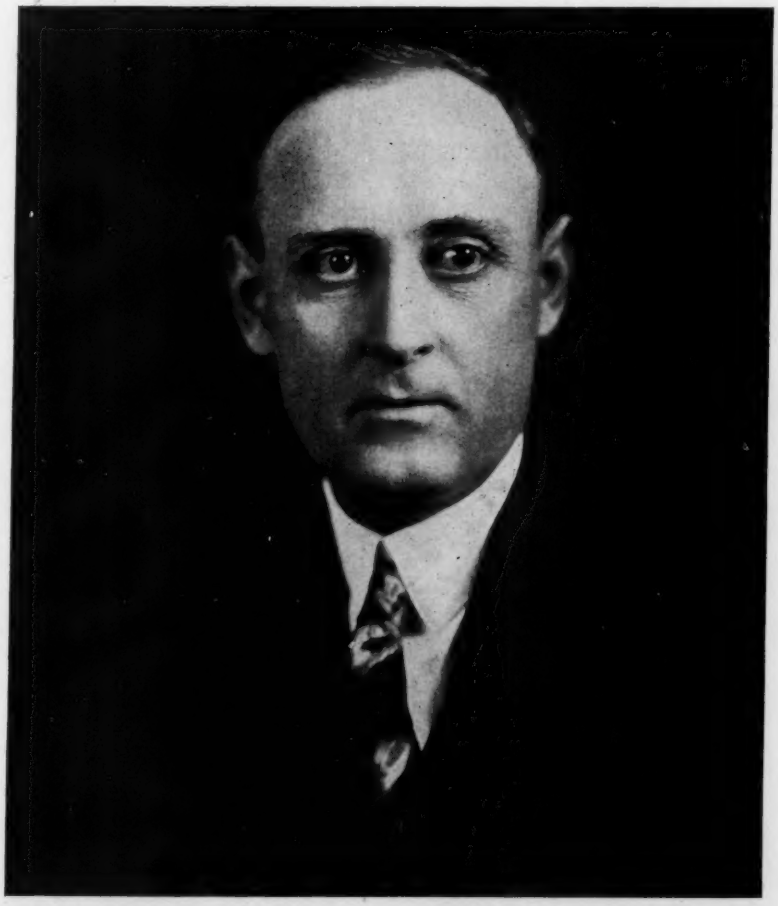
E. L. Peck, the retiring president, was presented with a watch from the association. S. C. Carney, elected a vice-president, made the presentation speech, styling himself "the spokesman for the president." He managed to make several shafts of humor sink into vulnerable spots, before presenting the watch.

Mr. Peck responded with a speech of appreciation.

H. A. Trower, sales manager of the Phillips Petroleum Company, the incoming president of the association, was introduced at the banquet. He made a talk in which he pledged his best efforts to the welfare of the body.

George L. Ratcliffe of the General Petroleum Company, Los Angeles, another vice-president, responded in behalf of the California delegation, which was the largest ever to attend a convention of the association.

Dr. E. R. Lederer of the Texas Pacific Coal & Oil Company, also elected



H. A. THROWER, SALES MANAGER OF THE PHILLIPS PETROLEUM COMPANY, PRESIDENT OF THE ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS.

S. C. CARNEY, ROXANA PETROLEUM CORPORATION, VICE PRESIDENT OF THE ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS.

DR. E. R. LEDERER, TEXAS PACIFIC COAL & OIL COMPANY, VICE PRESIDENT OF THE ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS.

GEORGE RATCLIFFE, SUPERINTENDENT OF NATURAL GASOLINE DEPARTMENT OF GENERAL PETROLEUM CORPORATION OF CALIFORNIA, VICE PRESIDENT OF ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS.

a vice-president, spoke in response to the invitation from the toastmaster.

The convention opened May 24 in the Mayo hotel. Due to business Frank L. Chase, vice-president of the association and vice-president of the Lone Star Gas Company, Dallas, was unable to be present to deliver the address of welcome. Secretary A. V. Borque took care of this part of the program, shortly turning the meeting over to E. L. Peck for the annual address of the president.

Work Reviewed

Work of the Gas Testing Committee was reviewed by George P. Bunn, of the Phillips Petroleum Company, vice chairman of the committee on that work.

Emby Kaye of the Skelly Oil Company brought the question of outage before the convention, with a talk on "The Outage Evil". He told of losses being imposed on makers of natural gasoline because the product is not being properly unloaded at refineries. His recommendation was that natural gasoline concerns make a concerted effort toward educating workers at refineries in proper methods of unloading natural gasoline.

A. F. Winn, traffic manager of the Skelly Oil Company, also spoke on the question of outage.

In the afternoon Emby Kaye was chairman. J. C. Chatfield of National Petroleum News read a paper, "Economics of the Natural Gasoline Industry."

Work of the research and educational program was reviewed by Secretary Bourque. He gave in detail the conditions that brought the association to its decision to engage in the effort, the work accomplished during the year, and made recommendations for continuing the work. This was adopted by the directors following the convention.

One of his recommendations was that a pamphlet be prepared to acquaint jobbers with the proper method of blending natural gasoline with refinery gasoline to get a definite motor fuel. This also is to be done.

A. M. Ballard of the Sun Oil Company, Tulsa, was chairman for the morning program of the second day. D. J. Wallace, director of the safety division of the Mid-Continent Oil & Gas Association, read a paper, "The First Law of Nature."

Many phases of the use and limitations of the portable plant came before the convention following the reading of the paper by S. S. Smith, superintendent of the gasoline division of the Roxana Petroleum Corporation on "The Unit Idea as Applied to the Gasoline Plant."

He brought out that the smaller portable plants have been supplanted to some extent by larger units, which still retain the desirable features of being easily and quickly moved with small loss from the salvage standpoint.

A. V. BOURQUE, SECRETARY OF THE ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS.

Much opposition to the smaller portable plant was voiced by several. It was defended by others, who contended that it had been used for improper purposes in many instances. Some criticism was made of methods used by manufacturers in selling the smaller units to persons and firms not experienced in gasoline plant operation.

The morning program ended with a paper "Co-Operation Between Plant and Office," by C. L. Swim, manager of the Insurance Department of the Skelly Oil Company.

The afternoon program of the second day found S. C. Carney of the Roxana Petroleum Corporation in the chair. F. B. Good of The Texas Company, Breckenridge, read a paper on "Water Treatment." He gave both the method and cost of treating water in that district.

"Fire Prevention as Applied to the Natural Gasoline Industry" was discussed by E. T. Ingalls, manager of the Oklahoma Inspection Bureau.

Dr. E. R. Lederer, vice-president of the Texas Pacific Coal & Oil Company, read the paper, "Gasoline Plant Lubrication." It was prepared by Dr. Lederer, O. S. Wyatt and F. R. Stanley, also with the Texas Pacific Coal & Oil Company.

All of the third day was given over to the report of the work of Dr. Brown, who had the floor much of the time.

Concerns which will name men to

(Continued on page 68)

Refinery Capacity Shifting to Integrated Companies

By GEORGE REID
Staff Representative

DURING the past few years there has been a marked tendency on the part of refiners toward both concentration of refining capacity at the points providing the largest market for their products, and rounding out of large integrated organizations throughout all sections of the country. This latter type of organization is with each succeeding year becoming more and more in control of the refining capacity of the United States, and at the expense of the other type of refining company, which, for lack of a better term, may be called "non-retailing."

The integrated type of company when so described, indicates a refining organization with outlet for its finished product, especially gasoline, through the establishment of company owned dispensaries—both service stations and bulk stations. Usually the integrated organization owns its own crude production, its own refinery, and its own distributing stations—though there are variations to this scheme, especially in the matter of owning production.

As a type however, the integrated company has both increased in number of such organizations, and in capacity of refineries, to a remarkable extent during the past few years. At present there are a great number of integrated companies which either own their own crude production or are assured of constant supply through permanent pipe line connections, and which refine their products in their own plants for the purpose of supplying the needs of their own great chains of filling and bulk stations, and a large portion of those companies now numbered among the integrated organizations, were, but a few years ago almost entirely lacking in company owned retail outlet, and dependent upon the jobber and marketer for distribution.

For the purposes of the present discussion a survey has been made of the territory termed the Mid-Continent, and the Chicago territory, in an effort to determine the trend of refining capacity. A resume and tabulation of all of the refining companies operating plants in 1924 was made, separating those which were at that time integrated companies, or retailers of gasoline, from those companies which were then non-retailers of motor fuel. A similar resume of companies engaged in the refining and marketing of petroleum products, both integrated and non-retailer's, was made covering the same territory to determine the status of refining capacity in 1927. As a result of this survey the remarkable growth and development of the "integrate company capacity" is forcibly presented.

In 1924 companies retailing their own refinery gasoline production had capacity in the Mid-Continent and Chicago territory of only 273,500 barrels daily, and the number of refining plants in these two territories operated by integrated, or retailing, companies was but 36 plants. During that year in the same territory there were 104 refineries with a total capacity of 356,640 barrels, these companies operating plants which were dependent upon the jobbing and brokerage trade for the distribution of their products. Integrated companies were far outnumbered in 1924. There were 68 more non-retailing refineries in operation than there were integrated or retailing refineries, and the capacity of the non-retailing companies was 83,140 barrels greater than the capacity of the total number of plants distributing their products through company owned stations.

What has happened in the past three years is indicative of the present trend in refining and marketing circles. The survey just completed is impressive in its forceful presentation of the fact that the refining company without its own outlet for its products is having a difficult time in surviving, and during the past three years a great number of these refineries have not survived. On the other hand, the integrated company, those owning and controlling their own outlet and distribution of their own products has advanced, expanded and enlarged to such a remarkable extent that the present total capacity of these companies is about three times greater than the present total capacity of the non-retailing organizations.

In 1924 the total capacity of the integrated type of company for the Mid-Continent and Chicago territory was but 273,000 barrels, this being the capacity of the 36 refineries in all of this territory then engaged in the marketing of their own products, but in 1927, just three years after the first survey, the capacity of the integrated companies in this area has increased to 535,250 barrels, or an increase of 261,750 barrels. The number of integrated refineries has increased in this time from 36 plants to 55 which indicates that during the past three years 19 refining organizations have changed their policy of operation and provided company-owned outlet for their product by the construction and purchase of service stations.

In the meantime there has been a great change in the status of the 104 refining plants previously mentioned as being non-retailers in 1924. This number has decreased to 64 plants in 1927 in the Mid-Continent and Chicago territory, or a loss of 40 refineries formerly in this class. If 19 of them have been transformed into the class of integrated companies, then 21 have been shutdown and abandoned because of their inability to show a profit when in operation. In 1924 this class of refining company had the previously stated capacity of 356,640 barrels, but during the period mentioned this capacity had decreased by 182,750 barrels, leaving the present refining capacity of the non-retailing company in the territory under discussion estimated at only 184,600 barrels. Thus practically half of the former capacity of the non-retailing company is gone, while the capacity in the same area of the integrated and retailing organizations has increased from 273,500 barrels in 1924 to 535,250 barrels in 1927. The following tables illustrate the transition of refining capacity which

TABLE 1
Refineries Without Company Owned Service Station Outlets
Mid-Continent and Chicago Territory

	1927		1924			
Sections—	Plants Operating 1927	Capac. Barrels 1927	Plants Operating 1924	Capac. Barrels 1924	Increase Capac. Barrels 3 Years	Decrease Capac. Barrels 3 Years
North Texas	23	67,100	27	74,750	....	7,650
North Louisiana	3	16,000	9	27,800	....	11,800
Arkansas	7	28,900	10	18,190	10,710	.....
Oklahoma	24	53,700	37	142,400	....	88,700
Kansas	4	14,700	15	69,000	....	54,300
Total Mid-Continent	61	180,400	98	332,140	10,710	162,450
Chicago territory	3	4,200	6	24,500	....	20,300
Totals, Mid-Continent and Chicago District	64	184,600	104	356,640	10,710	182,750

TABLE 2
Integrated Refining Companies, Mid-Continent and Chicago Territory

Section	Plants Operating 1927	Capacity Barrels 1927	Plants Operating 1924	Capacity Barrels 1924	Increase Capacity Barrels 3 Years
North Texas	10	61,250	9	54,000	7,250
North Louisiana	4	31,800	1	3,000	28,800
Arkansas	..	.....	..	.....	.....
Oklahoma	24	180,200	16	78,500	101,700
Kansas	8	82,000	5	34,000	48,000
Totals, Mid-Continent	46	355,250	31	169,500	185,750
Chicago District	9	180,000	5	104,000	76,000
Totals, MidContinent and Chicago District	55	535,250	36	273,500	261,750

has taken place during the past three years, and are indicative of the present trend in refining capacity.

It may be well to analyze here the changes that have taken place in each of the various districts of the Mid-Continent territory, taking them in the order as presented in the preceding tables 1 and 2.

North Texas Changes

In the North Texas district there are at present 10 integrated companies operating nine refineries having a total capacity of 61,250 barrels, which is an increase in "integrated capacity" of 7250 barrels over 1924 when nine companies where operating nine refineries of the integrated type with a capacity of 54,000 barrels.

In the same area the non-retailing companies have shown a decrease of 7650 barrels in capacity—decreasing from 74,750 to 67,100 barrels; while the number of such refineries has decreased from 27 to 23. At present there are eight refineries with a total capacity of 10,650 barrels which are shutdown and which were in more or less spasmodic operation in 1924, but which may now well be classed as permanently out of operation. The mortality rate of small skimming plants in this area has been indicating a steady decrease in the number of installations since 1922. With the loss of several refineries in this area over the last three years, there is still the same refining capacity in total of 139,000 barrels daily, and the maintenance of this figure has been due to the continued growth of the integrated type of company.

North Louisiana

In North Louisiana the companies operating plants included in the non-retailing class show a decrease in capacity during the past three years from 27,800 barrels in 1924 to 16,000 barrels in 1927—a decrease in capacity of 11,800 barrels. During the same period the number of integrated companies engaged in marketing their own products has increased in this district from one plant in 1924 to four plants in 1927—and the capacity of this class of operator has increased from 3000 barrels to the present figure of 31,800 barrels, or a gain in capacity of 28,800 barrels by the plants owned by the integrated companies. The five shut-down plants in this area were once in the non-retailing list, but their capacity of 5400 barrels may well be classed as permanently shut down.

Increase in Arkansas

Arkansas is the only state included in this survey of the Mid-Continent territory where the non-retailing type of refining company has shown any increase in capacity. In 1924 there were 19 refineries in Arkansas, of which 10 were operating with a total rated capacity of 18,190 barrels. There are but nine refineries listed in the latest Bureau of Mines survey with two plants shut down. The remaining seven operating plants have a total capacity of 28,900 barrels. The capacity loss of the 10 plants abandoned or dismantled during the past three years in Arkansas has been more than offset by the increase and enlargement of the seven remaining companies operating there and marketing their products through jobbing channels. Arkansas has never had an integrated type of organization operating in the state. During the past three years the capacity of refineries in operation in Arkansas has increased but 10,710 barrels.

Transition in Oklahoma

In the past three years in Oklahoma the integrated companies have increased capacity from 78,500 barrels to 180,200 barrels, or 101,700 barrels in this class of refinery capacity. There are now 15 integrated companies operating 24 plants refining gasoline in the State, as against 16 plants operated by nine integrated companies in 1924. The capacity termed as integrated has increased well over 100 per cent during this time.

On the other hand the total capacity of the non-retailing type of company has shown a marked decrease in Oklahoma. In 1924 there were 37 plants in this class with a total capacity of 142,400 barrels, which through various influences, such as conversion to the integral type of organization provided with its own retail outlet, etc., has decreased to the present capacity of 53,700 barrels, or a total decrease in this type of refinery capacity of 88,700 barrels during three years. The number of non-retailing plants has decreased from 37 to 24, or a decrease in refineries distributing their products through the jobber and marketer of 13 plants.

The present status of shut down plants in Oklahoma includes such plant installations that little hope should be held of their ever becoming active again. There are 20 of such shut down and more or less abandoned installations with an indicated capacity of 46,600 barrels daily. Virtually all of the shut down plants in Oklahoma, just as are practically all of the shut down refineries throughout the Mid-Continent territory, and other districts, are of the type which, if in operation, would be dependent mostly upon the jobbers and marketers for an outlet for their products. In the entire area covered by this survey there are only three refineries once operated by the larger companies or the smaller integrated companies which are shut down. These instances are due mostly to temporary abandonment or to plans of the companies involved to dismantle the equipment and install it elsewhere.

Kansas

Eight refineries owned and operated by integrated companies in Kansas have a present total rated capacity of 82,000 barrels. Three years ago, the integrated capacity of the state was only 34,000 barrels—the throughput of five plants. These figures show an increase in this type of refinery capacity of 48,000 barrels

On the other hand the capacity of the group of refineries classed as non-retailing has decreased in number of plants from 15 to four—a loss of 11 plants in this class. The capacity of the "non-retailing" refining plants in 1924 was rated as 69,000 barrels and during the past three years this capacity has decreased to the present rated total capacity of only four plants totalling 14,700 barrels. The decrease in this short period in Kansas is 54,300 barrels.

Six of the eight shut-down plants in Kansas have a rated capacity of over 2000 barrels, with the total shut-down capacity estimated at 16,000 barrels. It is highly improbable that any of these former non-retailing type of companies will again become active, since most of them have been listed among the shut down installations for several years. Kansas was formerly the source of much motor fuel and other petroleum products for the jobbing trade, but with the trend toward the integrated company type of organization, the refining capacity available to the jobber has steadily diminished, while the ever growing capacity of the integrated type of company has more than doubled. The same tendency is noticed throughout all of the separate districts of the Mid-Continent area, in North Texas, North Louisiana and

(Continued on page 120)

Experimental Plants Prove Value in Refinery Practice

REALIZATION that the raw product from which the refiner manufactures his finished commodities must be subjected to complete accurate analysis prior to its purchase has contributed to the development of the industry's scientific plant laboratories in no small measure. This marked tendency, which in the past few years has convinced even the most skeptical of operators of the value of scientific analysis and control of manufacturing processes, has done much to further the accomplishments of chemists and physicists within the refining industry. The old rule of thumb methods once familiar to petroleum refining have been abandoned almost universally, because the chemist has proven the worth of his investigations. The advent and extensive application of pyrogenic processes, cracking, has probably been the most forceful influence pointing to the essential importance of physics and chemistry and their intelligent direction and application in the solving of the refiners problems. Petroleum refiners have become convinced that just as the raw products of the several other major industries are bought and sold only upon the basis of quality, so must the manufacturing industry producing petroleum products base its purchases of crude upon the quality of that commodity. The determination of quality of crude oil is contingent upon the accurate analysis of the oil.

Former practice in the analysis of crude oils has embraced the distillation of small samples in glass apparatus in the plant laboratory. This practice has much to commend it, but as the quantity of petroleum undergoing analysis must necessarily be limited in volume when glass vessels are employed, the fractions obtained by such inspection are too small for commercial calculations and for subsequent inspection and analysis of these fractions. The chemist has, therefore, turned to the larger type appratus, constructed of steel, and of sufficient size to produce the necessary fractions in great enough volume for experimental work with them after they are distilled. The practice has become so general that few progressive refineries are without their miniature distilling and fractionating equipment.

There are two major uses for the miniature plant. One is the analysis of the raw crude oil, and secondly, the analysis of pressure distillates derived from the cracking unit. In the first instance, that of crude oil inspection, the miniature plant becomes important not only because of its ability to yield larger fractions from crude oil, but also because actual plant conditions may be duplicated.

Determining Value

In the matter of crude analysis the importance of such equipment is much in point when it is recalled that crude oils from different districts are of striking difference in their characteristics. Oil from a single field should be often analyzed for the reason that various sections of a given producing pool often produce oils of a different type, both physically and chemically different. Chemical variation of crudes running through a skimming plant often is noticed through the difficulty of ease with which the distilled fractions are treated. Physical differences show up in the percentage recovery of the distillates and their physical characteristics. The content of gasoline, for example, in a crude oil derived from a single field may vary appreciably, and it is governed by such conditions in the field, as storage conditions and length of time stored, vacuum applied to the well and dehydration of the oil. With continued inspection of the crude the actual value or worth of the given oil is determined. Regardless of its gravity rating, the refiner is becoming more and more accustomed to basing his purchases upon this predetermined value.

The analysis of such oil sample in small quantities in glass apparatus is, of course, of much value, but this analysis should be carried further by subjecting larger quantities of the crude to distillation and fractionation in the miniature plant. The first test may well be called mere inspection, for the knowledge of the crude secured is but meagre, and is usually limited to the volume or percentage recovery of the given distillates. Steam distillation is difficult and those fractions removed below the kerosene cut are inadvertantly subjected to some cracking.

Questions Answered

The subsequent analysis of a comparatively large volume of the oil in the complete miniature plant results in the accu-

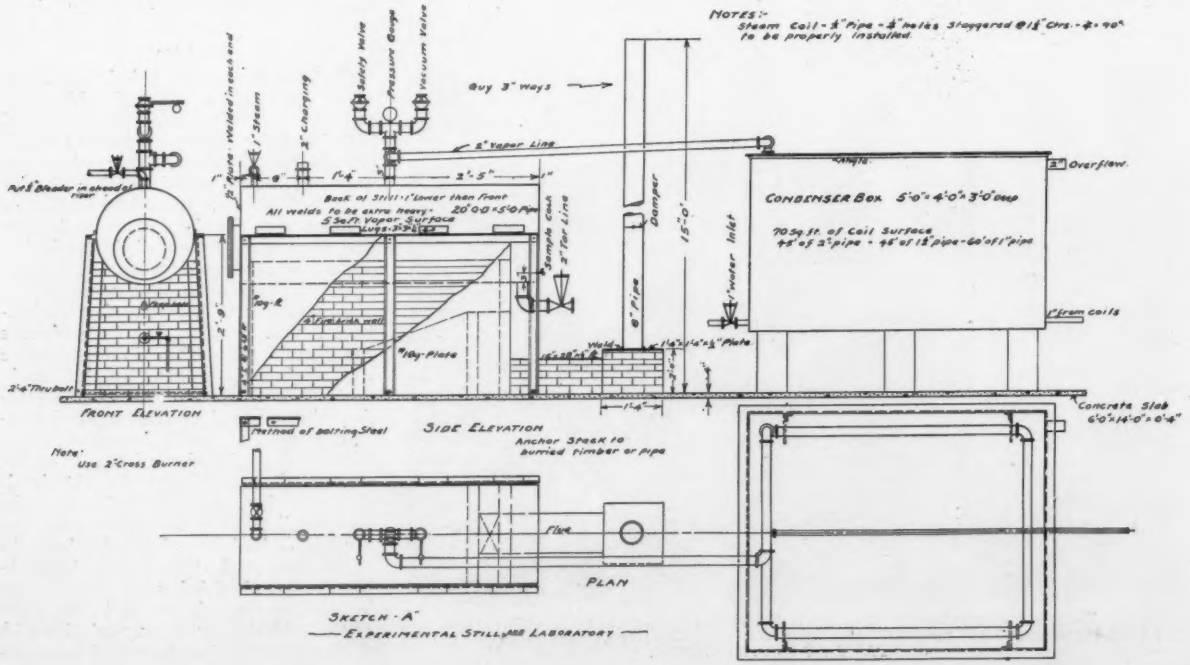

NOTES:-
Steam Coil - 3" Pipe - 3" holes Staggered @ 18" Ctrs. - 2 - 90°
to be properly installed.
Buy 3" ways
2" Vapor Line
Safety Valve
Pressure Gauge
Vacuum Valve
1" Steam
2" Charging
Add 8" Breeder in ahead of riser
Book of Steel - 1" Lower than Front
All welds to be extra heavy - 20'-0" = 5'-0" Pipe
5 Sq. Ft. Vapor Surface
Sample Cock
2" Tar Line
Damper
15'-0"
8" Pipe
1" Water Inlet
Overflow
CONDENSER BOX 5'-0" × 4'-0" × 3'-0" deep
70 Sq. Ft. of Coil Surface
48' of 2" pipe + 48' of 1" pipe = 66' of 1" pipe
1" from coils
Weld
1/4" × 3/4" Plate
Concrete Slab
6'-0" × 14'-0" × 0'-4"
Thru bolt
FRONT ELEVATION
Method of bolting Steel
SIDE ELEVATION
Anchor Stack to buried timber or pipe
Note: Use 2" Cross Burner
Flue
PLAN
SKETCH - A"
EXPERIMENTAL STILL AND LABORATORY

FIGURE 1.—COMPLETE CONTINUOUS MINATURE REFINERY INSTALLED AT PONCA CITY FOR EXPERIMENTAL PURPOSES BY THE BUREAU OF MINES, THROUGH THE BARTLESVILLE, OKLAHOMA, EXPERIMENTAL STATION. COMPLETE PIPE STILL AND FRACTIONATING COLUMN (BUBBLE TOWER) TYPE OF SMALL PLANT.

mulation of fractions of sufficient bulk to enable the further analysis of the cuts. The mere distillation of crude for gasoline content is no longer acceptable. What kind of gasoline is yielded; what difficulty will be experienced in treating the product; what is its sulphur content. These and other important questions are readily answered. A weathered or dehydrated crude oil may yield a gasoline low in gravity, because of the loss of light vapors, and this heavy gasoline may be more difficult and more costly to treat because of the higher concentration of the impurities. The kerosene fraction from crudes coming from different sections of a given field, for example, may present a variation of problems in treating and bleaching. Steam distillation in the steel apparatus aids in preparing this cut duplicating plant practice. Steam distillation of the gas oil, and wax distillate cuts make it possible to prepare them with sufficient care and accuracy that they, too, may be subjected to further analytical methods.

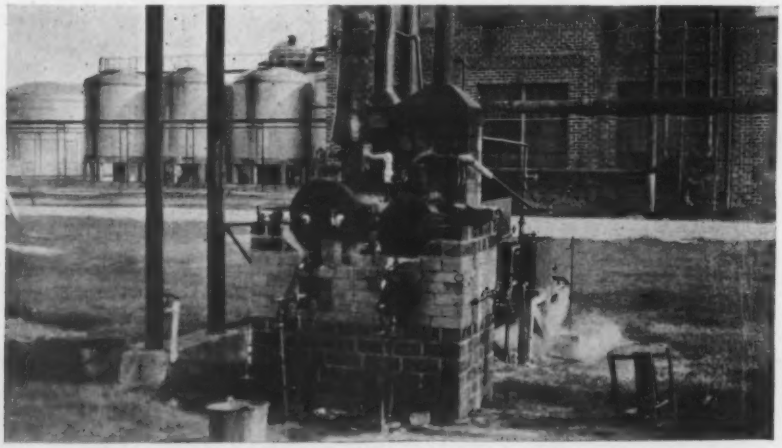


FIGURE 2.—EXPERIMENTAL STILL AND TOWER INSTALLATION USED FOR ANALYSIS OF CRUDE BY THE LABORATORY AT THE REFINERY OF THE PURE OIL COMPANY AT SMITHS BLUFF.

Direct fire applied, then, to the bottoms remaining in the still may be employed to reduce the fuel oil still lower, effecting the removal of the excellent grade of heavy gas oil charging stock for cracking units. Where the still is constructed of sufficient weight this product may be cracked, after the bottoms are removed from the still, and in this manner the value of the given crude sample as a source of cracking unit charging stock may be determined. Where gas oil is not prepared for the cracking units, then the miniature still may be used to crack the fuel oil experimentally. All of these features contribute to greater efficiency and better economy of refinery operation, for full knowledge is secured of the type of raw material to be handled by all departments—distillation, fractionation, treating, and cracking—and these departments are forewarned of the coming problems and how to solve them. Thus the laboratory by securing advance knowledge of the oil to be purchased and to be charged to stills, is enabled to provide the means of combating whatever problems may arise when crude oils are changed, before the change is made. In addition, the inspection and analysis prior to the purchase has done much to determine the value of the oil to the plant operator, as well as the price which can be paid for that oil.

All Steel

The miniature plant, entirely constructed of steel, often equipped with small efficient bubble or packed towers, and provided with adequate condenser surface, has become popular among laboratory workers for their experimental work with cracked distillates. The same quality of yielding large fractions of cracked gasoline from the pressure distillates is important in this consideration, the ease of steam distillation in such apparatus is also of value, and many chemists are convinced that results from experiments when conducted in glass do not correlate with similar work when carried on in steel. The treating problem in conjunction with the production of cracked gasoline is still of much importance, and through the utilization of the small, all steel, miniature refinery, the chemist is able to produce cracked gasoline from the pressure distillate of exactly the same type as those derived from the distillation units on the plant yard. Thus his treating problem is assured of being the same as that incurred at the agitators and the results of the analysis more nearly coincide with the results secured under actual plant con-

ditions. Such inspection and analysis is often conducive to lowered treating costs and to better treating results, all of which again points to better efficiency of plant operation.

Until recently the miniature experimental plant on the refinery yard has been usually of the batch type, but equipped with efficient fractionating columns. However, with the adoption of the tube still and fractionating devices of the refining industry has come the miniature plant of the same type for continuous operation—duplicating the new plant conditions exactly. One of the first pipe still and tower plants of small size, developed for experimental purposes was perfected by the Bureau of Mines and installed at Ponca City. This complete layout is shown in an accompanying photograph. The small plant is complete in every detail, including pumps, tanks, tube still, bubble towers, and scientific control instruments.

In the sketch—experimental still— is shown the details of construction and layout of a miniature installation for the

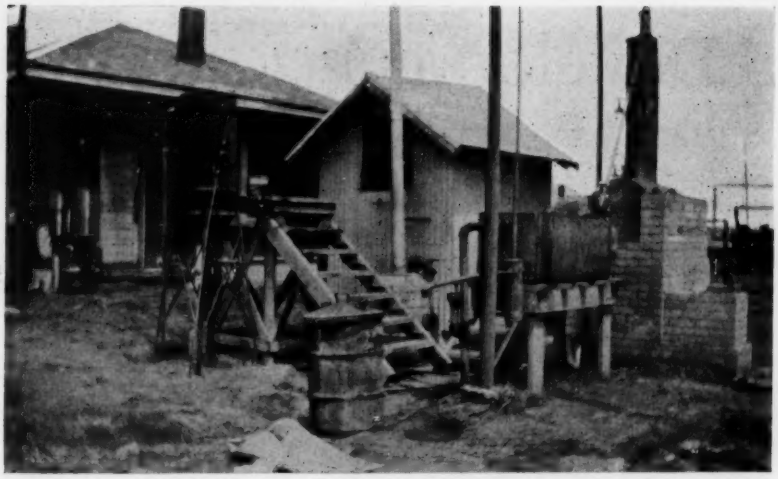


FIGURE 3.—MINATURE SHELL STILL, TOWERS AND STEEL AGITATOR USED EXPERIMENTALLY AT THE PANHANDLE REFINING COMPANY'S WICHITA FALLS PLANT.

FIGURE 4.—SMALL REFINING APPARATUS USED IN DETERMINING CRUDE VALUES BY THE WESTERN OIL & REFINING COMPANY AT WILMINGTON, CALIFORNIA

topping of relatively large samples of crude oil. The sketch and the following remarks as to construction and materials used are taken from a contribution by H. L. Minister, petroleum engineer, Denver, Colorado. "The apparatus is designed as a small skimming plant of sufficient size for commercial plant analysis of oil, which can be cheaply and easily constructed and does not require much floor space. It can be placed adjoining the laboratory.

"The experimental still is made from a piece of 20-inch (outside diameter) oil well casing, five feet in length. The ends are stopped with one-half-inch plate welded, with pipe nipples of the size shown in the diagram welded in the top and ends of the still to provide for vapor line, inlet charging line and outlet drain nipple and valve. A piece of eight-inch standard pipe is used as a smoke stack. The condenser box is constructed of scrap pieces of boiler steel.

"The rear end of the still is to be about one inch lower than the front to permit the still to be thoroughly drained after each experiment. There is allowance for five square feet of vapor surface.

"The condenser box contains 70 square feet of coil surface. There are 45 feet of two-inch pipe, 45 feet of one and one-half-inch pipe, and 60 feet of one-inch pipe, comprising the condenser coil, and this is circled around the inside of the condenser box, and resting upon steel pins welded to four vertical angles, which holds the pipe coil in place, as shown in the diagram.

"The amount of surface condensation is more than ample to properly take care of all vapors derived from the distilling crude charge, and this insures the best results in the analysis of the oil.

"The cost of constructing such an experimental still complete, including brickwork and other material, should be around $300, or less."

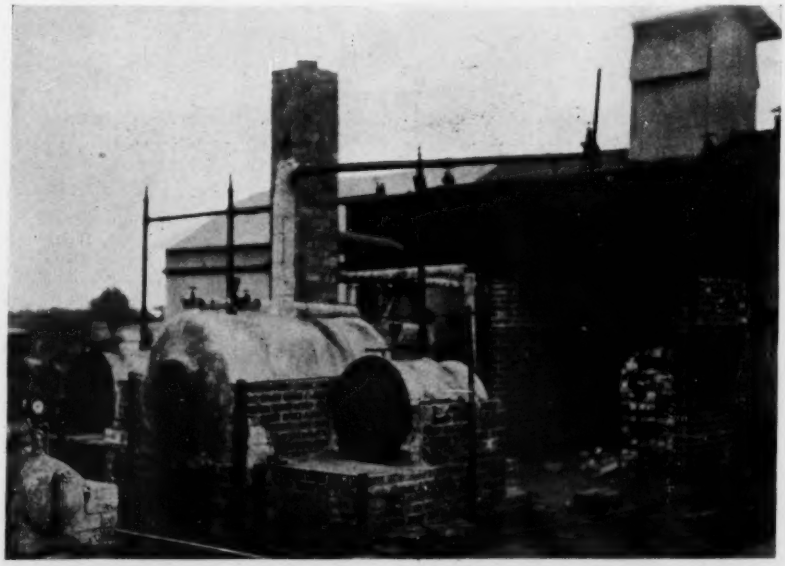


FIGURE 5.—MINATURE OF EXPERIMENTAL UNITS FOR SKIMMING USED BY THE BUREAU OF MINES EXPERIMENTAL STATION AT BARTLESVILLE.

Development of Natural Gasoline Industry in California

SIXTEEN years in the history of the development of natural gasoline manufacture from natural gas in California has seen that industry increase from the small beginning of seven operators with seven gasoline plants in 1912 to its present status of 60 operators who manufacture this product in about 179 plants. During 1912 the seven plants produced a total of 1,718,719 gallons of gasoline. During 1926, there was 395,162,981 gallons of gasoline manufactured by the 60 operators of almost 180 extraction plants. Table 1 shows something of the rate of development of the natural gasoline industry, from 1912 to and including 1926. Along with a steady increase in the number of plants installed each year, there is an accompanying increase in the thousands of cubic feet of natural gas treated, as well as an increase in natural gasoline produced. Of striking interest, however, is the development of the various types of absorption gasoline plants as compared to the compression method of extraction. Note that in 1917 there was only 5,339,083 gallons of absorption gasoline produced as against 23,478,521 gallons of compression gasoline. During the next five years there is seemingly a statistical struggle for supremacy between the two methods of extraction, but in that year, a great number of compression plants were either converted into absorption type of installations, or entered the class of combination absorption and compression units, with the result that almost twice as much natural gasoline was produced by the more efficient absorption system. There was 22,558,000 gallons of compression gasoline as against 44,559,000 gallons produced by absorption. Since that year there has been a steady decrease in compression gasoline production in California, and in 1924, only about thirteen million gallons of compression gasoline was produced as against 219,059,000 gallons of absorption. With a total production in 1926 of 395,162,981 gallons—it may be safely estimated that compression plants produced only thirteen to fourteen million gallons of this total. This estimate is borne out by the reports of the two types of manufacture covering production of natural gasoline in California during January and February of 1927—as shown in Table 2.

In Table 3 is listed the gasoline plant installations in California with details as to their ownership, location, rated capacity in gas throughput and type of plant. During the year 1926 there were several new plants installed in the various gas producing areas of the state, all of them being of the absorption type, and during this period there were also a number of plants discontinued, dismantled and moved, or temporarily shut down. These changes have resulted in the number of plant operators and the number of plants installed remaining about the same throughout the year. Five operating companies report the construction of 11 new plants in the territory, while four other companies report major enlargements and additions to 11 older installations.

TABLE NO. 2

California Natural Gasoline Production January, 1927.

Type of plant	Gas treated M. C. F.	Natural gasoline produced gallons.	Gasoline recovery per M. C. F. gas treated.
Oil Absorption	12,418,276	18,593,034	1.497 Gal.
Compression	317,576	510,275	1.617 Gal.
Comb. Comp. and Oil Absorption	9,037,186	14,353,409	1.588 Gal.
Comb. Oil and Charcoal Absorption	5,688,584	6,647,263	1.169 Gal.
Charcoal Absorption	1,065,973	195,815	.184 Gal.
Drip.—	.....	23,884	....
	28,523,595	40,323,680	1.414

California Natural Gasoline Production February, 1927.

Type of plant	Gas treated	Nat. gasoline produced gallons	Gasoline recovery per M. C. F. gas treated.
Oil Absorption	11,662,639	16,661,183	1.428 Gal.
Compression	288,674	478,627	1.658 Gal.
Comb. Comp. and Oil Absorption	8,214,702	13,144,835	1.600 Gal.
Comb. Oil and Charcoal Absorption	5,182,242	5,858,242	1.130 Gal.
Charcoal Absorption	1,116,403	140,983	.126 Gal.
Drip.—	.....	20,732	....
	26,464,660	36,304,814	1.372

TABLE NO. 1

Growth and Development of California National Gasoline Manufacturing Industry—1912 to 1926, Including Jan. and Feb. 1927.

Year	Number operators	Number plants	Compression	Absorption after 1922 including combination	Total production gallons	Value average per gal.	Gas M cubic feet.	Average yield per M cubic feet. gallons
1912	7	7 ...	.....	.....	1,718,719	10.1c	576,123	2.98
1913	12	14 ...	.....	.....	3,460,747	10.87	2,436,445	1.42
1914	17	19 ...	.....	.....	7,581,309	8.36	5,129,709	1.48
1915	18	20 ...	.....	.....	12,835,126	7.60	8,006,888	1.60
1916	28	26 ...	.....	.....	17,158,754	13.37	24,826,354	.691
1917	45	49 ...	23,478,521	5,339,083	28,817,604	15.40	43,351,247	.635
1918	29	56 ...	25,767,346	6,501,587	32,268,933	15.5	50,490,019	.64
1919	30	60 ...	29,484,543	10,902,253	40,385,796	14.2	36,647,251	1.02
1920	30	70 ...	35,347,691	12,860,285	48,207,976	17.3	43,772,395	1.10
1921	29	73 ...	36,947,374	21,273,124	58,220,298	17.0	55,650,328	1.05
1922	31	77 ...	22,558,000	44,559,000	173,329,000	9.6	211,409,000	.8
1924	61	140 ...	13,520,000	219,059,000	232,579,000	9.8	217,445,000	1.1
1925	61	149 ...	.....	.....	300,881,275	14.15	211,580,275	1.128
1926	60	176 ...	.....	.....	395,162,981	14.15	240,974,827	1.349
1927	..	... ...	.....	.....	.....	....	.....	....
Jan.	60	179 ...	510,275	39,813,412	40,323,678	14.15	28,523,595	1.414
Feb.	60	179 ...	478,627	35,826,187	36,304,814	12.13	26,464,660	1.372

TABLE 3—DETAILS ON CALIFORNIA GASOLINE PLANTS

COMPANY—	Location of Plant	No. of Plants	Type	Daily Capcy. M.C.F
Ahlburg Gasoline Company	Long Beach, 35th & Lime	1	Abs.	8,000
Ahlburg Gasoline Corporation	Long Beach, 35th & Lime	1	Abs.	8,000
American Gas Company	Santa Maria, Brookshire Lse.	1	Comb.	2,750
Associated Oil Company	Midway, Asso. 26-B	1	Abs.	2,800
Balell Gasoline Company	Midway, Balboa Lease	2	Abs.	4,000
Bankline Oil Company	Long Beach	1	Abs.	25,000
Bankline Oil Company	Santa Fe Spgs. G. P. Lse.	1	Abs.	30,000
Belridge Oil Company	Elk Hills, Sec. 34-S	2	Abs.	10,000
Brea Canyon Oil Company	Coyote Hills, Brea-Olinda Lse.	1	Comb.	2,000
California Gasoline Company	Huntington Beach, Savage Lse.	1	Abs.	3,000
California Gasoline Company	Huntington Beach, V-M Lse.	1	Abs.	2,000
California Gasoline Company	Long Beach	5	Abs.	31,000
California Gasoline Company	Montebello, Baldwin Lse.	1	Abs.	1,200
California Gasoline Company	Montebello, Red Star Lse.	1	Abs.	1,500
California Gasoline Company	Rosecranz, G. P., Vaughn Lse.	1	Abs.	10,000
California Gasoline Company	Santa Fe Spgs., Stoiny Lse.	1	Abs.	6,500
California Gasoline Company	Santa Fe Spgs., Getty Lse	1	Abs.	10,000
California Gasoline Company	Santa Fe Spgs., Mattern Lse.	1	Abs.	10,000
California Gasoline Company	Ventura., So. Mt. Lse.	1	Comb.	8,000
California Gasoline Company	Ventura, Shields Lse.	1	Abs.	1,500
Calumet Oil Company	Filmore	1	Comb.	500
Central Oil Company	Huntington Beach	1	Abs.	250
Cienaga Corporation	Filmore	1	Comb.	15,000
Coalinga Empire Oil Company	Coalinga	1	Abs.	200
Cowan Oil & Refining Company	Rosecranz, Padleford Lse.	1	Abs.	9,000
Export Refining Co.	Torrance, C. C. M. O.	2	Comb.	20,000
E. E. Combs	Long Beach, Los Cerritos	1	Abs.	500
Fellows Gasoline Company	Long Beach, Surbeck Lse	1	Abs.	25,000
Fellows Gasoline Company	Long Beach, Globe Lse.	1	Abs.	25,000
Fellows Gasoline Company	Huntington Beach	1	Abs.	15,000
Fullerton Oil Company	Coyote Hills, Brea Canyon	1	Comb.	3,100
O. C. Fields Gasoline Corporation	Huntington Beach, Holly Dev. Lse.	1	Comb.	6,000
O. C. Fields Gasoline Corporation	Sunset, Transport Lse. 7	1	Abs.	6,000
General Petroleum Corporation	Coyote Hills, Tonner Lse.	1	Abs.	10,000
General Petroleum Corporation	Long Beach, Walnut & Hill	1	Abs.	5,000
General Petroleum Corporation	Rosecranz, Athens	1	Abs.	5,000
General Petroleum Corporation	Rosecranz, Howard Townsite	2	Abs.	12,000
General Petroleum Corporation	Rosecranz, Marine Lse	1	Abs.	500
General Petroleum Corporation	Santa Fe Springs	1	Abs.	20,000
General Petroleum Corporation	Ventura, Barnard Lse.	1	Abs.	10,000
Gilmore Oil Company	Long Beach	1	Abs.	10,000
Gilmore Oil Company	L. A. Salt Lake (Los Angeles	1	Abs.	2,000
Gilmore Oil Company	Sunset, Sec. 34-32-34	1	Abs.	2,000
Gralan Oil Company	Midway, Gralan Lse.	1	Abs.	400
Holly Oil Company	Huntington Beach, Holly Lse.	1	Comb.	4,000
Honolulu Cons. Oil Company	Midway, Honolulu Lse	3	Comb.	30,000
Hugh B. Evans, Inc.	Midway, Evans Lse.	1	Abs.	250
Interstate Oil Company	Sunset, Sec. 36-3-24	1	Abs.	400
La Habra Gasoline Company	Fullerton, Graham-Loftus Lse	1	Abs.	5,000
La Habra Gasoline Company	Fullerton, Hole Lse.	1	Abs.	5,000
La Habra Gasoline Company	Fullerton, Hualde Lse.	1	Comb.	5,000
Lomita Gasoline Company	Long Beach, Jergins City Lse.	1	Abs.	10,000
Lovell Gasoline Corporation	Midway, California Pet. Pl. No. 6	1	Comb.	2,500
Lovell Gasoline Corporation	Midway North American Con.	1	Comb.	3,000
Lovell Gasoline Corporation	Midway, Boston-Pac. Lse.	1	Abs.	2,000
Lovell Gasoline Corporation	Sunset, Ethel D. Lse.	1	Abs.	2,000
Lovell Gasoline Corporation	Torrance, Superior Lse.	1	Abs.	6,000
Miley, E. J.	Rosecranz, Athens	1	Abs.	1,000
Mutual Gasoline Company	Long Beach	1	Char.	10,000
North American Oil Cons.	Midway, Sec. 28-B	1	Abs.	2,000
Norwalk Company	Santa Fe Spgs, G. P. Lse.	1	Abs.	30,000
Olig Crude Oil Company	Midway, Sec. 32-31-23	1	Abs.	50
Olinda Gasoline Company	Coyote Hills C. C., M. O. Lse	1	Comp.	1,500
Olinda Gasoline Company	Coyote Hills, C. C. M. O. Lse.	1	Bstr.	....
Pacific Natural Gasoline Company	Long Beach, American Ave.	1	Abs.	6,000
Pacific Natural Gasoline Company	Long Beach, Los Cerritos	1	Abs.	1,000
Pacific Natural Gasoline Company	Rosecranz, Miley-Marland No. 2	1	Abs.	7,000
Pacific Natural Gasoline Company	Rosecranz, Miley-Marland No. 3	1	Abs.	9,000
Pacific Natural Gasoline Company	Rosecranz, Athens	1	Abs.	10,000
Pacific Natural Gasoline Company	Santa Fe Spgs., Pac. Pet. Lse	1	Abs.	600
Pan American Western Petroleum Co.	Elk Hills, Crampton K. Lse.	1	Comb.	15,000
Pan American Western Petroleum Co.	Elk Hills, Sec. 34-30-24	1	Bstr.	9,000
Pan American Western Petroleum Co.	Long Beach, Temple & Arbelle	1	Comb.	2,500
Pan American Western Petroleum Co.	Torrance, Marbel Lse.	1	Comb.	3,500
Petroleum Securities Company	Inglewood, Ruble Lse.	1	Comb.	11,000
Rancho La Brea Oil Company	L. A.-Salt Lake (Los Angeles)	1	Comb.	5,000
Rice Branch Oil Company	Santa Maria, R. R. Lse.	1	Abs.	1,000
Rio Grande Oil Company	Long Beach, Ramsey Lse.	1	Abs.	9,000
Rio Grande Oil Company	Santa Fe Spgs., Gett-Baker Lse.	1	Abs.	1,300
Rex-Gasoline Corporation	Long Beach	1	Abs.	5,000
Richfield Oil Company	Huntington Beach, Republic Lse.	1	Abs.	2,500
Richfield Oil Company	Midway, Calidon Lse.	1	Abs.	1,750

(Continued on next page)

DETAILS ON CALIFORNIA GASOLINE PLANTS—Continued

COMPANY—	Location of Plant	No. of Plants	Type	Daily Capcy. M.C.F
Richfield Oil Company	Sunset, Sec. 32-12-24	1	Abs.	2,500
Ryan & Hackett	Long Beach, Interstate Lse.	1	Abs.	1,200
Ryan & Hackett	Rosecranz, Athens	1	Abs.	200
Ryan & Hackett	Rosecranz, Pac. Pet. Lse.	1	Abs.	400
Sentinel Oil Company	Torrance, Joughin Lse.	1	Comb.	10,000
Shell Company of California	Coalinga, Sec. 26	1	Abs.	4,000
Shell Company of California	Coyote Hills, Columbia Lse.	1	Abs.	2,000
Shell Company of California	Coyote Hills, Grazide Lse.	1	Abs.	10,000
Shell Company of California	Dominguez, Reyes Lse.	1	O.&C.	20,000
Shell Company of California	Long Beach, Coseboom Lse.	1	O.&C.	30,000
Shell Company of California	Santa Maria, Careaga Lse.	1	Abs.	2,000
Shell Company of California	Ventura, Gosnell Lse.	..	O.&C	100,000
Signal Gasoline Corporation Inc.	Long Beach	2	Abs	20,000
Signal Gasoline Corporation Inc.	Long Beach	2	Abs	12,000
Signal Hill Gasoline Company	Long Beach, United Haas Lse.	1	Abs.	5,000
Signal Hill Gasoline Company	Long Beach United Denni Lse.	1	Abs.	3,000
St. Helens Petroleum Company Ltd.	Coyote Hills, Johnson Lse.	1	Abs.	2,500
St. Helens Petroleum Company Ltd.	Midway, King Lse.	1	Abs.	2,500
St. Helens Petroleum Company Ltd.	Midway, Schultz Lse.	1	Abs.	2,500
St. Helens Riverside Props.	Montebello, Monterey Lse.	1	Abs.	2,500
Standard Engineering Company	Dominguez, Callender Lse.	1	O.&C.	8,000
Standard Engineering Company	Inglewood, Shell Rindge Lse.	1	O.&C.	4,500
Standard Engineering Company	Newhall	1	O.&C.	15,000
Standard Gasoline Company	Belridge, Chan Lse.	1	Comb.	550
Standard Gasoline Company	Coyote Hills, Birch Lse.	1	Abs.	900
Standard Gasoline Company	Coyote Hills, Murphy Coyote Lse	1	Comb.	11,500
Standard Gasoline Company	Elk Hills, Sec. 35-S.	1	Comb.	7,500
Standard Gasoline Company	Elk Hills, Sec. 31-S	1	Abs.	5,000
Standard Gasoline Company	Elk Hills, Hay Lse.	1	Comp.	4,000
Standard Gasoline Company	Elk Hills, Tupman Lse.	1	Comb.	1,000
Standard Gasoline Company	Huntington Beach	1	Comb.	14,000
Standard Gasoline Company	Huntington Beach, Asso. Fowler	1	Abs.	5,000
Standard Gasoline Company	Huntington Beach, Miley-Kick	1	Abs.	5,500
Standard Gasoline Company	Inglewood Asso. Vicker Lse.	1	Abs.	6,500
Standard Gasoline Company	Inglewood Baldwin Lse.	1	Abs.	3,750
Standard Gasoline Company	Inglewood L. A. I. No. 1 Lse.	1	Comb.	14,380
Standard Gasoline Company	Long Beach	3	Abs.	58,000
Standard Gasoline Company	Midway, Derby Lse.	1	Comb.	2,640
Standard Gasoline Company	Midway, Eagle Creek Lse.	1	Comb.	500
Standard Gasoline Company	Midway, McNee Lse.	1	Comb.	8,340
Standard Gasoline Company	Midway, Fellows	1	Abs.	3,800
Standard Gasoline Company	Midway, Kerto	1	Abs.	30,000
Standard Gasoline Company	Midway, Lakeview	1	Abs.	6,000
Standard Gasoline Company	Midway, Puritan	1	Abs.	6,800
Standard Gasoline Company	Midway, Sixteen	1	Abs.	6,500
Standard Gasoline Company	Midway, 19-G	1	Abs.	6,500
Standard Gasoline Company	Midway 29-G	1	Abs.	6,000
Standard Gasoline Company	Midway, 33-G	1	Abs.	3,000
Standard Gasoline Company	Midway, Midway	1	Bstr.	5,000
Standard Gasoline Company	Midway, Nine D.	1	Bstr.	6,500
Standard Gasoline Company	Midway, Sec. 28	1	Comp.	165
Standard Gasoline Company	Midway, Sec. 30	1	Comp.	470
Standard Gasoline Company	Montebello, Baldwin Lse.	1	Abs.	1,200
Standard Gasoline Company	Newhall, Pico Lse.	1	Comb.	240
Standard Gasoline Company	Richfield, Karmer No. 2 Lse.	1	Comb.	5,750
Standard Gasoline Company	Rosencranz, Superior-Maxwell	1	Abs.	2,000
Standard Gasoline Company	Santa Fe Spgs., Asso.-Green Lse.	1	Abs.	5,000
Standard Gasoline Company	Santa Fe Spgs., Elliott-Clark	1	Abs.	20,000
Standard Gasoline Company	Santa Fe Spgs., Gertrude Lse.	1	Comb.	4,970
Standard Gasoline Company	Santa Fe Spgs., Whitter	1	Bstr.	....
Standard Gasoline Company	Torrance, Marble Fee	1	Comb.	3,260
Standard Gasoline Company	Ventura, Asso.-Lloyd No. 1	1	Abs.	17,500
Standard Gasoline Company	Ventura, Asso.-Lloyd No. 2	1	Abs.	20,000
Standard Gasoline Company	Ventura, Asso.-Lloyd No. 3	1	Abs.	35,000
Standard Gasoline Company	Wheller Ridge, Kerns Co. No. 2	1	Comb.	935
The Petroleum Company	Coyote Hills, Gilman Lse.	1	Abs.	300
The Redondo Company	Torrance, Cunningham Lse.	1	Abs.	3,000
Torrance Gas & Refining Company	Torrance C. C. M. O. Lse.	1	Abs.	12,000
U. S. Refining Company	Davidson City	1	O.&C.	30,000
Union Oil Company of California	Coyote Hills, Stearns No. 3	1	Abs.	10,000
Union Oil Company of California	Coyote Hills Stearns No. 2	1	Abs.	3,500
Union Oil Company of California	Dominguez, Hellman Lse	1	Abs.	28,500
Union Oil Company of California	Huntington Beach, Copeland Lse	1	Abs.	5,000
Union Oil Company of California	Richfield, Morse Lse	1	Abs.	12,000
Union Oil Company of California	Rosecranz	1	Abs.	17,000
Union Oil Company of California	Santa Fe Spgs., Bell Lse.	1	Abs.	12,000
Union Oil Company of California	Santa Maria, Newlove Lse.	1	Abs.	12,000
Union Oil Company of California	Ventura Torrey, Lee Lse.	1	Abs.	350
Universal Cons. Oil Company	Lst Hills	1	Abs.	750
West Coast Refining Company	Richfield Bradford Lse.	1	Abs.	8,000

Abbreviation—Abs.—Absorption. Bstr.—Booster. Char.—Charcoal Absorption. Comb.—Combination Compressor and Absorption. Comp.—Compressor Plant. O. & C. Combination Oil and Charcoal Absorption.

Length 46 ft. Inside diameter 10 ft.
Wall thickness 2½ inches.
Weight 166,000 lbs.

Safety and Savings by Smith

In a single month the A. O. Smith Corporation has produced as many oil refinery pressure vessels as are produced by all the rest of the industry in a year.

Size of Stills

Smithsteel Cracking Stills can be built to any diameter and length within transportation limits—and in any wall thickness within steel mill capacity.

Safety

Smithsteel Cracking Stills have a continuous record of successful operation in the field under the most exacting and varied conditions.

Every Smithsteel Vessel is tested not only with reference to operating conditions but is subjected to pressures which may be three or four times as great as those which the vessel will encounter in actual operation. These tests are invariably made in the presence of purchasers' representatives.

Cost

Smithsteel Cracking Stills do cost more than vessels made by some other methods. The extra cost is the price of safety.

Speed in Getting New Refinery Units into Production

Smithsteel Cracking Stills shorten the time needed to get new refinery units into production.

Because of the completeness and scope of the A. O. Smith Corporation's plant and equipment, Smithsteel Vessels can be built in less time than is required by other manufacturers.

In a single month the A. O. Smith Corporation has produced as many oil refinery pressure vessels as are produced by all the rest of the industry in a year.

In addition, the methods of fabricating Smithsteel Vessels assure extreme accuracy.

You can, therefore, prepare superstructure, piping, etc., in advance with absolute certainty that Smithsteel Cracking Stills will fit.

The A. O. Smith Corporation will gladly place complete information before you.

A. O. SMITH CORPORATION *Milwaukee, Wisconsin*
Oil Field Products Division Los Angeles

How One Concern Insulated Its Brine And Chilled Oil Lines and Tanks

By H. L. KAUFFMAN
Associate-Member, A. S. M. E.

THE proper and efficient insulation of brine (calcium chloride) and chilled oil lines and tanks in a refinery manufacturing lubricating oils is a matter of interest to every refinery executive. Insulating oil and brine lines and tanks against the warmth of the outer air is necessary at some point in the manufacture of paraffin or mixed-base lubricating oils, regardless of whether or not neutral oils are being made from wax distillate; or whether bright stocks, or other cold-settled stock, are being made from cylinder stocks either by cold-settling or by the centrifugal process.

Furthermore, the growing interest on the part of refiners in the manufacture of bright stocks and so-called "long residuums" by the Sharples centrifugal process for the removal of wax makes the present subject matter all the more of timely interest. Nearly two dozen plants of the latter-mentioned type have already been constructed and placed in operation, while at least a half dozen more at present have already been constructed and arrangements are now being made for their construction.

It is not the purpose of the present article to describe either the construction of such plants or the manner in which oils are made by this process; but, instead, merely to describe and to discuss the method of insulating the lines and tanks that are part of the Sharples dewaxing plant at the Parco, Wyoming, refinery of Producers and Refiners Corporation. This plant was completed in December, 1924 by J. G. White Engineering Corporation, and has been in operation since that time at such intervals as were necessary to keep on hand a stock of finished lubricating oils. The plant has a capacity of 333 barrels of finished stock per day and is different from any other type of Sharples plant ever constructed in that, because of the extremely high wax content of the crude oil used, provision had to be made for passing the diluted, chilled stock twice through the centrifuges in order to obtain a satisfactory cold test on the reduced oil. Twenty-one Sharples centrifuges and two Carbondale refrigerating machines, atmospheric type, having a capacity of 100 tons each, are part of the essential equipment installed in this plant.

Insulated Lines

Brine lines that are insulated in this plant, the method for the insulation of which will be described later, are as follows:

1. Six-inch line from brine tank to 8 x 8½ x 12-inch brine pumps.
2. Six-inch brine line to coolers from 8 x 8½ x 12-inch brine pumps.
3. Six-inch cold brine line to 8 x 8½ x 12-inch brine circulating pumps and relief to brine tank.
4. Four-inch circulating brine line from 8 x 8½ x 12-inch brine circulating pumps to 25 feet diameter by 30 feet high first chilling tank.
5. Four-inch circulating brine line from 8 x 8½ x 12-inch brine circulating pumps to 25 feet diameter by 30 feet high second chilling tank.
6. Four-inch brine return line from first chilling tank to brine tank and to 8 x 8½ x 12-inch brine circulating pumps.
7. Four-inch brine return line from second chilling tank to brine tank and to 8 x 8½ x 12-inch brine circulating pumps.

The above listed brine lines are located both inside the Sharples plant building proper and outside the building where they are exposed to weather conditions.

Chilled oil (at a temperature of minus 10° F.) lines that are insulated at the Parco Sharples plant are as follows:

1. Four-inch suction line from the 25-foot diameter by 30-foot first chilling tank to the 6 x 6 x 6-inch Kinney rotary pumps.
2. Four-inch discharge line from the 6 x 6 x 6-inch Kinney rotary pumps to supply tank No. 1.
3. Four-inch line from supply tank No. 1 t othe 7 primary centrifuges.
4. Four-inch run-down line from the 7 primary centrifuges to the 43-foot diameter by 10 foot high first-run, wax-free oil tank.
5. Eight-inch suction line from the first-run, wax-free oil tank to a No. 2 Roots pump.
6. Six-inch charging line from the No .2 Roots pump to the second chilling tank.
7. Four-inch suction line from the second chilling tank to the 6 x 6 x 6-inch Kinney rotary pumps.
8. Four-inch discharge line from the Kinney rotary pumps to supply tank No. 2.
9. Four-inch line from supply tank No. 2 to the 14 secondary centrifuges.
10. Four-inch discharge line from the 14 secondary centrifuges to the second run-down tank.

The above listed chilled oil lines are located also both inside the Sharples plant building proper and outside the building where they are exposed to weather conditions.

Johns-Manville "built-up" insulation was used both for the brine and for the chilled oil lines mentioned above.

Inside Insulation

The following was the method used in insulating all brine and chilled oil lines inside of the building:

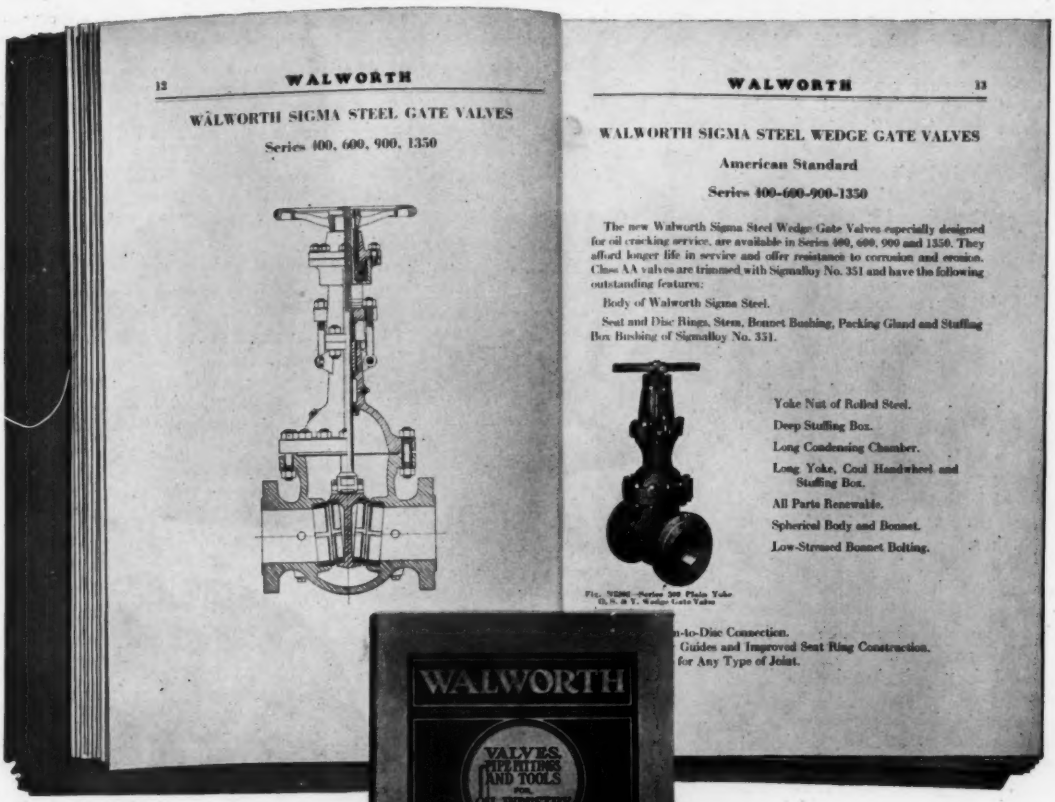
1. All the pipe and fittings were first cleaned and wiped dry.
2. Next was applied one layer of Johns-Manville sealing waterproof membrane, wrapped spirally.
3. Next, a layer of one-inch insulating hair-felt, which was securely fastened in place with strong twine.
4. Thereafter was applied three more additional layers of one-inch insulating hair-felt, all abutting and longitudinal joints being staggered.
5. Next was placed on the lines a 1-ply thickness of sealing waterproof membrane in 2-ply construction.
6. Two coats of waterproof sealing compound were next applied, the first coat being allowed to set before applying the second.
7. Next was fastened on the lines two layers of waterproof paper.
8. On top of the paper a canvas jacket was thereafter sewed on.
9. The canvas jacket, finally, was painted with two coats of paint. Paints of different colors were used to indicate more readily each type of line.

Outside Installation

The method of insulating the lines outside the building, and exposed to the weather, was similar to the method of insulating the inside lines with the following exception:

Instead of applying two layers of waterproof paper, sewing on a canvas jacket and then painting same, the lines were covered with a weather-protecting jacket. This jacket consisted of a layer of Johns-Manville 2-ply Salamander roofing, which was applied with its white side exposed, and thereafter being properly cemented at its joints and further secured at four-inch intervals with twisted twines of No. 16 copper wire.

On both the inside and outside chilled oil and brine lines, all fittings and flanges were covered with the same thickness of hair-felt as on the pipe. A waterproof sealing cap was


12 WALWORTH
WALWORTH SIGMA STEEL GATE VALVES
Series 400, 600, 900, 1350
WALWORTH 13
WALWORTH SIGMA STEEL WEDGE GATE VALVES
American Standard
Series 400-600-900-1350
The new Walworth Sigma Steel Wedge Gate Valves especially designed for oil cracking service, are available in Series 400, 600, 900 and 1350. They afford longer life in service and offer resistance to corrosion and erosion. Class AA valves are trimmed with Sigmalloy No. 351 and have the following outstanding features:
Body of Walworth Sigma Steel.
Seat and Disc Rings, Stem, Bonnet Bushing, Packing Gland and Stuffing Box Bushing of Sigmalloy No. 351.
Yoke Nut of Rolled Steel.
Deep Stuffing Box.
Long Condensing Chamber.
Long Yoke, Cool Handwheel and Stuffing Box.
All Parts Renewable.
Spherical Body and Bonnet.
Low-Stressed Bonnet Bolting.
WALWORTH
VALVES, PIPE FITTINGS AND TOOLS FOR OIL INDUSTRY

The new WALWORTH OIL BOOK

SEND FOR YOUR COPY

Have you been hunting through the seven hundred and fifteen pages of the big Walworth catalogue to find just what you want in valves, fittings and tools?

Here is a new book that puts all of our oil industry materials in a compact 100 pages. All the Walworth Sigma Steel valves and fittings from Series 150 to Series 1350 and all the different sizes of unions, casing heads and wrenches are included.

Over in the back of the book is a lot of dope on velocities, volumes and pressures that you will find mighty useful.

Just say the word and we'll be glad to send you a copy.

WALWORTH

Walworth Company, General Sales Offices: 51 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.

. . . Distributors in Principal Cities of the World . . .

Walworth, Ltd., 10 Cathcart St., Montreal, P. Q.
Walworth International Co., New York, Foreign Representative

applied to enclose the ends of pipe insulation at all fittings, flanges, etc.

Hair-felt insulation was applied to the liquid end of five 8 x 8½ x 12-inch Worthington duplex pumps, three 6 x 6 x 6-inch Kinney rotary pumps and one No. 2 Roots pump installed in the pump room of the Sharples plant building proper.

Essential chilled oil tanks and refrigerating apparatus that had to be insulated at the Sharples plant at the Parco refinery of Producers and Refiners Corporation are as follows:

1. Four 25 x 30-foot first and second run, steel, chilling tanks, all of which have flat roofs.
2. One 43 x 10-foot first-run, wax-free oil tank. This tank has a conical roof rising 2 feet, 8 inches from shell to center of roof.
3. One 10 x 6 x 6-foot deep steel brine tank. This tank has a flat roof.
4. Two 9 x 4-foot chilled oil supply tanks. These tanks have a conical roof and bottom, the depth of the cone being 6 inches.
5. Two 1 foot, 6 inches by 7 feet, 5½ inches steel, horizontal, shell type anhydrous coolers. These coolers are located on concrete foundations within the building proper.
6. Two 3 feet, 7 inches by 15 feet, 11 inches steel, horizontal, shell type brine coolers, which are located on suitable foundations within the building proper.
7. Four 2 x 8-foot steel, vertical, shell type heat exchangers, which are placed upon cast-iron supports within the building proper.
8. Two 4 feet, 6 inches by 20-foot steel, horizontal, shell type generators, which are also fitted upon cast-iron supports in the Sharples building proper.

The steel chilling tanks contain a chilled petroleum oil, the temperature of which is reduced to as low as minus 10 degrees to minus 15 degrees F. The steel foundations rest on Sil-o-Cel brick, 5 inches thick, this in turn resting upon an 8-inch concrete slab. The sides and roofs only of these tanks were insulated.

Insulation of Sides

The tank surfaces, having previously been cleaned, were painted with a single coat of asphaltic paint. The tank was then insulated with four ¾-inch layers of Johns-Manville "Tankinsul," applied in hot asphalt (200 degrees F. melting point), the surfaces being coated with this asphalt. The "Tankinsul" was applied in vertical layers in continuous sheets, breaking the joints, and being held in place by wire which was wrapped around the entire circumference of the tank. The fourth, or outside layer, of Tankinsul was held securely in place by 1½-inch mesh chicken wire, which was laced and made tight. The chicken wire was then given a mop coat of asphalt (200 degrees F. M. P.) and the surface finished smooth.

The insulation at the bottom of the tank was made to extend over the Sil-o-Cel brick, care being taken to be sure that the whole was made weather proof and air-tight.

Thereafter, a weather-proofing protection of five inches of hollow tile was applied next to the Tankinsul. All flanges, man-ways and other projections throughout were flushed and made weather-proof and air tight.

Insulation of Roofs

The insulation of the roofs of these tanks was similar to that used on the sides with the exception that in place of the weatherproofing protection of hollow tile, which was used on the sides, there was applied a layer of 2-ply Johns-Manville "Phoenix" asbestos felt roofing, followed by a second layer of 2-ply Johns-Manville "Salamander" asbestos felt white top. All roofing was laid in hot, asphaltic cement. The roofing insulation was made to extend over the side insulation, and all possible precautions were taken to make the side insulation weatherproof at this point. As was done in insulating the sides of these tanks, so too in insulating the roofs were all the flanges, man-ways and other projections flushed and made weatherproof and air-tight.

The sides and roof of the 43 x 10-foot first-run, wax-free oil tank were insulated in a manner similar to that described above.

The 10 x 6 x 6-foot steel brine tank contains a solution of calcium chloride brine at approximately minus 10 degrees to minus 15 degrees and is located upon a concrete foundation on the roof of a concrete building where it is exposed to weather conditions. The sides, roof and bottom were insulated.

Insulation of Sides and Roof

The sides and roof of this tank were insulated in a manner similar to that followed in insulating the tanks previously mentioned, with the exception that after the chicken wire was fastened securely in plac,e the whole was then given a smooth trowel cement finsh. Over this then was placed one layer of 10-ounce sail duck, made tight over the surface, sewed securely in such a way as to be free from wrinkles or other irregularities and, consequently, presenting a smooth surface finsh. The sail duck was then painted with a coat of white, waterproof paint.

Insulation of Bottom

The bottom of the tank was insulated with two 3-inch layers of cork board, having a density of 0.9 lbs. per board foot, and applied in hot asphalt (200 degrees F. M. P.). All the joints were broken and the insulation was made firm and smooth to give the tank a solid and level foundation. The tank was supported upon creosoted pine supports, the cork board laying in between the wooden supports. All possible care was taken so that the side insulation of Tankinsul would make an air-tight and waterproof joint with the bottom, cork insulation.

The 9 x 4-foot chilled oil supply tanks contain a chilled petroleum oil which, at times, is as low in temperature as minus 10 degrees to minus 15 degrees F. They are located on the third floor, inside, of the Sharples building and rest upon a concrete foundation. The sides, roofs and bottoms of these tanks were insulated in exactly the same manner as the 10 x 6 x 6-foot steel brine tank described above.

The heads and shells of the 1 foot, 6 inches x 7 feet, 5½ inches steel, horizontal, shell type anhydrous coolers were insulated in a manner similar to the insulation of the 10 x 6 x 6-foot steel brine tank previously described, with the exception that five ¾-inch layers of Tankinsul were applied in insulating the brine tank.

The heads and shells of the 3 feet, 7 inches x 15 feet, 11 inches steel, horizontal, shell type brine coolers were insulated in a manner similar to the insulation of the anhydrous coolers, with the exception that six ¾-inch layers of Tankinsul were applied in insulating these brine coolers as compared with the five layers used in insulating the anhydrous coolers.

The four 2 x 8-foot steel, vertical, shell type heat exchangers and the two 4 feet, 6 inches by 20-foot steel, horizontal, shell type generators were insulated (that is the shell only) according to the standard practice followed by the Carbondale Machine Company in insulating these particular items of refrigerating equipment.

The reader is not to infer from this article that the methods of insulating brine and chilled oil lines, tanks and refrigerating equipment described herein is the only satisfactory and efficient method of insulating such equipment, but rather that the insulation and method of application as described is what one refiner has found to be entirely satisfactory and efficient after same has been in use for two years.

It must further be remembered that this refinery, located as it is in Wyoming, where excessive heat conditions are not encountered during summer months, requires slightly different insulation (that is, a tendency towards less insulation) on outside brine or chilled oil lines or tanks than would a similar plant located, let us assume, in the Mid-Continent, where the outside temperature is often above 100 degrees F. for long periods of time. Hence, the present description is given primarily as a guidance to the engineer or executive in determining the insulation to be used on chilled oil or brine lines or tanks whenever such a problem comes up for consideration in connection with the efficient operation or construction of that particular part of his own refinery.

TRANSMIGRATION of TRANSPORTATION

When Robert Fulton launched the Clermont and witnessed the cumbersome, paddle-slapping result of his genius lumber up the green, tugging, sucking Hudson, he was no doubt thrilled with the achievement.

But what would have been his thoughts to see the modern 400 horsepower marvels that skim the liquid mirror as a water spider.

Paddles and steam are replaced by propellers and gasoline, and such speed is obtained by a fuel well balanced with the powerful essence of NATURAL GASOLINE.

CHESTNUT & SMITH
CORPORATION
Tulsa . Oklahoma

Weekly Inspections Reduce Safety Hazards at Baytown

The Humble Company keeps refinery workers searching for ways to eliminate accidents

By GEORGE REID
Staff Representative

"TAKE Safety Seriously." "Make Baytown the safest refinery in the world."

These are possibly two of the most popular phrases, as well as two most important slogans, with the 2500 employes of the Humble Oil and Refining Company at this company's major refinery at Baytown, Texas.

While it is admittedly difficult to measure the numbers of beneficial results to either employe or company organiztaion, the safety program with the Humble organization has resulted directly in a marked betterment of morale and a lower accident rate. Those in charge of the work at the refinery endeavor to impress upon their fellows the importance of always working "safe," both for their own sake, as well as for the purpose of eliminating deprivation to their families. The indirect results as well as the direct effects of any one accident may be far reaching—thus the primary purpose of any safety campaign is the training of the individual employe to use every precaution in going about his daily routine.

The company maintains a well organized Safety and Welfare Department which functions continuously and with the co-operation of all the department heads. Combined effort toward the goal of fewer accidents prevails throughout the organization, and it is this spirit of active co-operation of which the safety department is most proud. Without the interest of the men on the plant yard, the campaign might easily fall flat. But when each employe is keenly interested in his own and his fellows' welfare, the program of safety begins to pay immediate dividends.

This spirit as exists at the Baytown refinery may be directly attributed to the fact that from the ranks of the employes in both the mechanical and the process departments, are taken the representatives of the men who actively engage in the campaign of safety.

Two Committees

In addition to those directly in charge of the routine of the Safety and Welfare Department, which consists of the safety engineer and his assistants who look after and perform the routine duties in conjunction with carrying on the work, training men in first aid work —the preparation and hanging of posters,—there are two active committees. The first committee which is termed the Central Safety Committee consists of five men who are selected from the two departments of mechanics and process, and who are directly in charge of numbers of employes. These men, who because of their training and positions in the organization are best fitted to decide just what constitutes a hazard when such is reported, also have the authority to remedy promptly any such conditions whenever necessary. They are selected for this committee from such positions as assistant superintendents in charge of distillation, chemical treating and cracking coil operation, general labor foreman, or chief engineer.

In their connection with this central safety committee each of these five men has a certain district in the plant yards or property to look after. This means, for example, that when a hazard is reported as existing in a certain portion of the plant equipment, the task of quickly correcting the conditions falls upon one member of the central safety committee and to him such a hazard is immediately reported for correction.

The second committee, termed safety committee, consists of seven committees of three men each. These men, who are selected from the ranks of employes, are chosen by the central safety committee from lists of names supplied by its five members.

Zones Inspected

The plant yard is divided into seven zones, each of which is served by one of the committees of three employes. Each week these seven committees intimately examine their respective zones. The next weekly inspection finds the committees of three in numerical progression, and where as committee No. 1 first inspected Zone No. 1, the second week finds them working in Zone No. 2. This policy takes each committee of three men over the entire plant and back to the zone first inspected in a period of two months.

At the expiration of this time the chairman of each committee of three is retired, while committeeman No. 2 takes the chairmanship for two months, committeeman formerly No. 3 becomes No. 2 and at the expiration of two months will become chairman. Thus seven new safety committeemen are appointed every two months—to cover the entire plant in all seven zones a number of times before he progresses through the chairmanship and is retired.

There are many obvious compensating advantages to be secured by such a policy. A committee of three taken for example, one from the boiler house, one from the tin shop and one from the compounding plant, is enabled to thoroughly inspect each department and zone of the great refinery, and to acquaint himself not only with the hazards in his own peculiar type of work, but with the dangers existing in all of the departments in which his fellows labor. There is an old bromide to the effect that one sometimes cannot "see the woods for the trees"—and by sending the men throughout the entire installation from all parts of the refinery, the stranger in a department new to him may and often does note conditions existing which are not exactly safe and recommends their correction, which the man daily employed in the department has perhaps constantly overlooked.

Write It Down

As the seven committees progress through the seven zones of the plant yard they carry with them a form upon which they carefully record any or all items which might constitute a hazard to the welfare of workmen.

Upon this slip the investigation committee upon their rounds, which are taken during working hours, note any condition needing repair.

Perhaps cast iron steps are needed at some point in the distillation equipment, guard rails may have been removed by workmen making repairs, without returning them, a fence may be in need of repair, a new hand rail may be necessary where rust and corrosion have destroyed its permanency or caused its weakness; a new ladder, or renewed rungs in an old ladder may be required, and so on throughout the plant innumerable items may engage the scrutiny of the inspecting group. Tools, for example, with which the machinists, pipe fitters and other mechanics perform their work are carefully inspected frequently—and any tool which is unsafe is either discarded or repaired. Such items are reported by the safety committee on the type of form referred to above, and at the end of the

inspection these forms are handed to those in charge of the routine work in the safety and welfare department.

Report, Then Action

The reported hazards are then carefully sorted and disseminated after recording on another and larger form by number, date and location, to the members of the central safety committee. Each of these five men receive those reports of hazards which have to do with that district of the refinery installation for which he is directly responsible. Upon receipt of the notation the member affected immediately investigates the matter, and if in the judgment of the central committeemen the recommendation is at all deserving of attention, correction or repair, then laborers are assigned to removing the hazard.

Some of the many results of this type of safety campaign are easily obvious to one visiting the plant. The important item of "toe rails," for instance, are everywhere prevalent whereever there is any possibility of an employe slipping when working at any height from the ground. All evidence of loose brickwork in the plant is missing. Gauge hatches on tank tops have all been moved to the edge of the tanks, close enough so that the gauger performing his work 10, 20 or 30 feet above ground, need never climb upon the tank top proper, but may guage from the platform at the top of the steel stairs. All metal foot plates are rough to prevent slipping.

In the high pressure department, where 26 cracking units are in service, the installation has been provided with wide clear alleyways between batteries wherever possible, so that the operators may have sufficient room to get away, or to combat fire in its event. Long stem or remote control valves are everywhere in evidence, and thick, brick fire walls are erected between the control sections and the coils proper. Every precaution pointing to safe operation of this type of unit has been carefully looked into and prepared.

In the mechanical departments all machines are posted with metal signs which briefly state:

"This machine will bite—Be careful of your fingers." Emery stones, grind stones, etc., are all provided with glass shields to prevent flying sparks from entering the workman's eyes—and innumerable goggles are found everywhere.

At the time of the writer's visit electricians were vigorously scouring and scrubbing their heavy rubber gloves. After this washing, they were dried, sprinkled with talc, and given a high voltage test. Electricity will "run over" a dirty glove. Clean, air and electricity tested, gloves are required of these workmen for their safety.

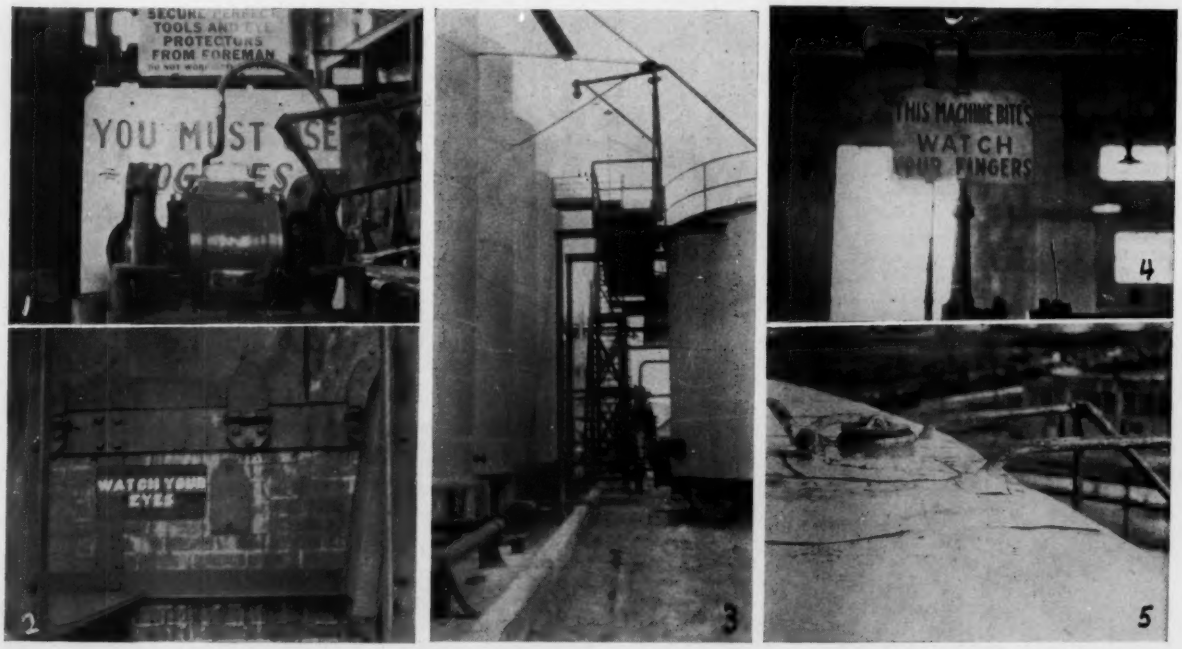
At 21 different stations throughout the plant, and their location indicated by large white enameled signs, are distributed hospital stretchers. Although it is desired never to use them, these stretchers are always handy and in all parts of the plant, for caring for the injured in the event of accident.

Needless to state, many chemical extinguisher wagons are stationed about the plant, a great number of small hand type fire extinguishers, as well as the additional protection of an extensive system covering all tanks on the plant site.

Gas Control

Wherever natural gas is used for firing, the piping conducting gas to the furnace is double-valved, and between these valves is placed a small outlet valve and plugged nipple. Whenever any condition brings a furnace out of service both large valves on the main gas line to the furnace are closed tightly, but the smaller valve between the two, and outside of the furnace, is opened so that any natural gas escaping through the larger valves on the line is conducted out into the air and not allowed to enter the furnace. This eliminates the danger of having a furnace flash back due to slowly accumulated gas which may have leaked into it while the furnace was out of service, when it becomes necessary to again light the fires. The small valve to take care of leaking gas may well be called a safety valve, for its sole purpose is one of assuring safety to the furnace attendant.

Upon the recommendation of the seven committees of three constituting the safety committee inspecting the grounds weekly, the central safety committee has kept reported hazards so well cleaned up and corrected that as the months have passed and the work has rounded itself into shape, the number of recommendations has been steadily reduced. In November of 1925 the inspection tours resulted in finding of only 20 hazardous conditions on the plant.



NUMBER 1.—IN ALL SHOPS OF THE MECHANICAL DEPARTMENT THE HUMBLE OIL AND REFINING COMPANY PROVIDES GUARDS FOR THE SAFETY OF THE EMPLOYEE WITH REMINDERS TO USE HIS GOGGLES AND TO SECURE ONLY PERFECT TOOLS BEFORE BEGINNING HIS WORK. NUMBER 2.—AT EVERY PEEP HOLE IN THE FURNACE WALLS CAUTION TO "WATCH YOUR EYES" IS GIVEN. NUMBER 3.—STEPS AND PLATFORMS OF STRUCTURAL STEEL, INCLUDING THE IMPORTANT FEATURE OF WIDE "TOE RAILS" ARE USED. NUMBER 4—BRIGHT ENAMEL SIGNS GIVE WARNING OF POSSIBLE DANGER TO WORKMEN'S HANDS. NUMBER 5.—GUAGE HATCHES ON ALL TANKS HAVE BEEN REMOVED TO THE OUTER EDGE MAKING IT UNNECESSARY FOR THE WORKMAN TO LEAVE THE STEEL, GUARDED PLATFORM AT THE TOP OF THE APPROACH STEPS.

Natural Gasoline Research Program To Be Continued

(Continued from page 52)

be added to the board of directors are: Lone Star Gas Company, Fort Worth; Empire Gasoline Company, Bartlesville; Chestnut & Smith Corporation, Tulsa; Roeser-Pendleton, Inc., Fort Worth; Oklahoma Gasoline Plants, Inc., Sapulpa; Prairie Oil & Gas Company, Independence; Marland Refining Company, Ponca City; L. W. Wentz, oil division, Ponca City; Barnsdall Oil Company, Tulsa; Sun Company, Tulsa; Oil State Gasoline Company, Tulsa; Transcontinental Oil Company, Tulsa; Shaffer Oil & Refining Company, Tulsa.

Gasoline Manufacturers Vote on Specifications

Tulsa.—Members of the Association of Natural Gasoline Manufacturers are now voting by mail on the proposal of the board of directors to correct the upper gravity limit on grade C natural gasoline to read 92 degrees A. P. I. gravity instead of the present 90 degrees A. P. I.

The directors approved the change at their meeting here following the sixth annual convention.

Another proposal approved by directors and submitted to members for vote by mail was to adopt the copper strip test for corrosion on gasoline.

The board also considered adoption of the doctor test specification for natural gasoline. It was decided, however, to take no action on this, pending action that may be taken by the Western Petroleum Refiners Association, American Society of Testing Materials and the Society of Automotive Engineers on the doctor test specification. There has been some consideration of abandoning this test on gasoline.

Directors of the association will meet each month in the future. The second Tuesday of each month has been fixed as meeting dates. In the past meetings of the board have been held on call.

New committees to serve the organization this year are now being selected by H. A. Trower, the new president. The committee list of the association includes, executive, technical, specifications, gas contracts, membership, traffic, tank cars, gas testing, education and research, finance and sales managers.

Braun Opens New York Office

Alhambra, Cal.—C. F. Braun & Company announces the opening of a sales and engineering office at New York City, in the French Building, 551 Fifth Avenue.

William D. Moorer is manager of the new office. His staff of trained engineers is prepared to make engineering surveys and to submit quotations on Braun products.

Natural Gasoline Supply Men's Association Formed

Formation of the Natural Gasoline Supply Men's Association resulted from the entertainment fostered by manufacturers for the annual convention of the Association of Natural Gasoline Manufacturers in Tulsa, May 24, 25 and 26. While all details of organization have not been completed, sufficient has been done to assure its completion.

The organization of supply men will bear a relation to the other body similar to the relation existing between the Natural Gas Association and the Natural Gas Supply Men. The two organizations will interlock through the board of directors.

The Natural Gasoline Supply Men's Association will have nine members on the board of directors. One of these will be the president of the Association of Natural Gasoline Manufacturers. The two organizations will have one secretary, A. V. Bourque, who has been secretary of the parent body since its formation.

When plans were being made for the Natural Gasoline convention, several manufacturers and dealers in supplies fostered a plan of taking over all entertainment, other than the annual banquet. This consisted of two Dutch lunches and a smoker. The smoker, with cabaret entertainment, provided a high spot in the annual convention.

In the future the plan is for the Natural Gasoline Supply Men's Association to take over all entertainment for the annual convention in Tulsa. This will include the annual banquet, as well as lunches and perhaps a smoker.

Because of the part the supply men will take, the Association of Natural Gasoline Manufacturers has agreed to a reduction of dues to associate members, who contribute to the entertainment features. The amount of this will be decided later.

Permanent organization of supply men took place the afternoon of the second day of the convention. Possible members met and discussed plans in a tentative style. A committee consisting of J. H. Satterwhite, Westcott & Greis, Inc.; W. C. Cummings, Gas Engineering & Supply Company; W. G. Schleuter, Refinery Supply Company; Forest Dunlop, Bessemer Gas Engine Company, and D. W. McKay, Hope Engineering & Supply Company, was named to draft the constitution and by-laws and select the name.

The day after the convention, the tentative plan was accepted by directors of the Association of Natural Gasoline Manufacturers.

In planning the entertainment for the convention just passed, concerns not previously holding associate memberships were automatically taken into the organization through contribution to the entertainment fund.

Manufacturers and supply dealers responsible for entertainment of the annual convention follow: Atlas Supply Company, Continental Tank Car Company, Refinery Supply Company, Westcott & Gries, Inc., Hope Engineering & Supply Company, C. & G. Cooper, Gas Engineering & Construction Company, The Refiner & Natural Gasoline Manufacturer, General American Tank Car Company, Tulsa Boiler & Machinery Company, Bessemer Gas Engine Company, Union Draft Gear Company, G. M. Davis Regulator Company, Ingersoll-Rand Company, The Foxboro Company, American Car & Foundry Company, Champlin - Fulton Manufacturing Company, Oil & Gas Journal, Metric Metal Works, Magneto Ignition Corporation, Acme Tank Car Company, C. J. Tagliabue Company, Smith Separator Company, Worthington Machinery Corporation, National Petroleum News, Neilan, Schumacher & Company, North American Car Company, Taubman Supply Company, Bruce McBeth Engine Company, Pennsylvania Tank Line Company.

The rush necessary for completing plans prevented many of the associate members and others from coming into the entertainment effort. With the affiliated organization formed of associate members, plans are to increase the associate membership materially by next year.

Other concerns already associate members of the Association of Natural Gasoline Manufacturers include: Bartlett-Hayward Company, C. F. Braun & Company, Continental Supply Company, J. A. Campbell, Dearborn Chemical Company, Fisher Governor Company, N. M. Muir, National Supply Company, New Orleans Refining Company, Newton Process Manufacturing Company, Oil Conservation Engineering Company, Paige & Jones Chemical Company, Pittsburgh Equitable Meter Company, Woodbank Pump & Machinery Company.

Larger Units to Replace Burned Stills at Parco

Parco, Wyo.—The Producers and Refiners Corporation, is replacing the six small cracking units, recently destroyed by fire, at its plant here with two large Dubbs units. The two large units under construction will have the same capacity rating as that of the six units being dismantled. Four of the smaller units which were damaged by fire will be reconditioned and again placed in operation. Repair work and new construction has been started at the plant and the cracking department at the plant will again be in full operation in a short time.

Tank Car Branch Office

Dallas, Texas.—The North American Car Corporation of Chicago, has opened a branch office here in the Republic Bank Building, with R. W. Patterson in charge.

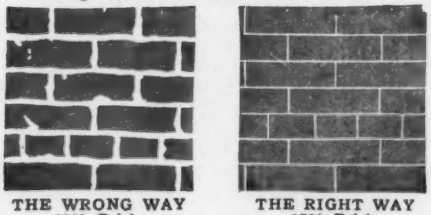
This office will enable the company's Southwestern customers to keep in closer touch with the home office. The company builds and leases tanks cars.

QUIGLEY PRODUCTS
For the Oil Industry

HYTEMPITE
(Reg. U.S Pat. Off.)

The standard for comparison in high temperature cements. It sets at normal temperatures and retains its strength up to temperatures at which the best quality fire brick loses strength and becomes soft.

Compare these Fire Brick Walls



THE WRONG WAY
89% Brick,
11% Fire Clay Joint

THE RIGHT WAY
97% Brick,
3% Hytempite Joint

Used for furnace and boiler settings and repairs; for setting tile, retorts, oil stills, lining metal melting furnaces, pit furnaces, foundry cupolas and ladles and for patching hot furnaces.

400 pounds of Hytempite will lay 1000 brick—this factor should be considered in figuring cost of fire brick work.

Ask for copy of "Hytempite in the Power Plant."

QUIGLEY REFRACTORY GUN

This gun handles pre-mixed refractories or other materials. It shoots the plastic mixture with high velocity at any place in wall or arch of furnace. The mixture will stick to a hot or cold wall, owing to force of application, in cases where troweled or rammed-in application might fail to hold. With the Quigley Gun you can:

Fill Cracks or Holes
Restore a Burned Out Wall
Fill Gaps in Walls or Arches
Re-surface Old Walls
Repair Leaky Baffles
Build New Baffles
Surface New Walls

And in many cases you can make repairs while the furnace is hot.

A whole battery of furnaces can be repaired in the time formerly required to repair one.

Used by many large Industrial Plants and Public Utilities. Details are described in *Booklet RG* 130.

TRIPLE-A
ANTI ACID ALKA AQUA
SOLUTIONS

PROTECT YOUR PLANT AND EQUIPMENT FROM CORROSION. They meet the demand for real protection under most severe conditions. They are not "just paints." They combine the three essentials for a real protective coating for Iron, Steel, Galvanized and plated surfaces, concrete, stone, cork insulation, creosoted wood, etc. They are alkali and waterproof and resist the action of acids and acid fumes.

TRIPLE-A Solutions are now protecting Oil Tanks, Pipe Lines, plant equipment and machinery in the oil fields and refineries of this country.

QUIGLEY FURNACE SPECIALTIES CO., Inc.
26 Cortlandt Street, NEW YORK, N. Y.

There is a Quigley Distributor with stock and service in every Industrial and Oil Center.

The Unit Idea As Applied to the Natural Gasoline Plant

*By S. S. SMITH**
Superintendent Gasoline Production, Roxana Pet. Corp.

IN choosing this subject, of course, I take advantage of every speaker's privilege to interpret his subject as he sees fit, so that the title of this paper should really be "The Unit Idea as Applied to the Gasoline Plant."

My first experience with absorption gasoline plants concerned the construction and operation of what I believe was the second of this type ever built in the State of Oklahoma. The construction of this plant, which at the top of its hey-day never made over 2500 gallons of gasoline daily, involved the use of as much concrete as is used in three modern plants of like size and required six months to complete. I recall that shortly afterwards I had some connection with an unsuccessful compression plant built near Sapulpa, which also had some $40,000 worth of concrete as one of the major items in its first cost, and which to the best of my knowledge never made gasoline enough to pay its operating expenses through any one month and, when dismantled, cost the builders over one-half of its first cost as a direct loss. Ever since that time it has seemed to me there was something radically wrong with a commercial industry which, like the proverbial physician, had to bury all of its mistakes.

About three years ago I had the opportunity of meeting one of the more progressive manufacturers of gasoline plant equipment and we discussed the possibility which might exist for the manufacture of gasoline plant apparatus and the gasoline producers in designing and building plants which could be set up and operated with practically no permanent foundations and with as little unsalvageable equipment as possible. I am convinced that, as a direct outcome of this conversation the first small portable units were put upon the market. As was possibly particularly fitting, my company purchased and installed the first two of these plants put in the Mid-Continent Field. Their operation, while it left much to be desired, still convinced us that the inherent idea was correct and that there were tremendous possibilities in the use of this equipment as a standard apparatus around which should be built the auxiliaries necessary to the complete program of gasoline manufacture.

Evolution of Portable

At that time none of us had a very clear picture of what we were trying to do, and as far as I am concerned the idea did not crystallize until almost a year later. It might be well to take up more or less in detail how this unit idea grew and what its effect and its relationship are toward other new features in the general scheme of oil and gasoline production.

Our first units were put in strictly as portable plants with no particular thought as to their efficiency and with the real incentive of obtaining some gasoline production from a very rich piece of producing territory while our permanent plant was in the course of construction. They were built in a hurry, had no gas compression machinery as we ordinarily know gas compression machinery, had practically no concrete foundations, no provisions for later additions or subtractions, and, of course, no particular efficiency of operation. We brought our gas in through temporary lines, mostly laid on top of the ground, handled it through blowers which were driven by steam engines, generated our steam in ordinary oil field boilers which were set about as the ordinary drilling contractor sets a boiler, and in general, the plants could hardly be considered as commercially successful. However, with this first installation we averaged about 5000 gallons a day for a period of approximately three months, at the end of which time our permanent plant was completed and began operations. These plants were then dismantled and moved to another flush gas location where they repeated practically the same experience.

At about this time it fell to my lot to take charge of the operations of my company's gasoline department and I immediately found it necessary to build a plant on heavy flush production where, in order to make it successful, it was necessary to contract outside gas in a field where there was severe competition from a plant already installed. With our other experience fresh in our minds, we decided that we could set up a portable plant and gas compressors in a small installation much more quickly that we could fabricate and build an ordinary permanent installation.

Quick Building

This plant as built was more or less of a makeshift and had not auxiliary room equipment as we ordinarily know it, but made gasoline at the rate of about 3500 gallons a day in some 35 days after we started construction. Almost immediately we found it necessary to double its capacity, and it was quite easy to do this by simply adding a record distillation unit and two more compressors. In this instance we used 80 horsepower direct driven gas compressors and the water circulation which handled the gas coolers was in series with the engine cooling water. For cooling and reservoir capacity we used a 1600-barrel tank and a small louvre tower with screen wire decks.

This installation only operated about four months and when the field unexpectedly went to water we were able to take out the plant, charge off against our operation the cost of setting up, dismantling and loading 33-1/3 per cent depreciation on all equipment together with our normal home office and overhead expense and still realize a small profit. Had we been unwise enough to install permanent apparatus the financial outcome would have been entirely different for my company, and, I fear, quite disastrous to me personally.

This insulation only operated about brought us to the serious realization of the fact that some of our deeper, short-lived pools might be made to support plants. If we were able to handle the flush production at a profit, then we could actually afford to build on a great many situations where with our more permanent, less salvagable equipment we were economically forced to determine accurately the extent and life of the field before starting construction. In our own case on this kind of field I know we were not willing to make the investment in large permanent plants which was necessary to compete with some of the major gasoline producers since we felt and still feel that the normal hazards of the business are sufficient to make it interesting without unnecessary and excessive competition plus unknown field extent. This attitude is proved by our present very serious depression to have been the correct one. Buyers of casinghead gas too frequently forget the hazard of the business in their desire to build up gallonage and more often than not offer competitive conditions which may give them a fair return on their investment if everything goes right, but more frequently must result in losses. Today's situation brings us all back to earth.

Two Roads

We were then faced with the choice between two courses of procedure. We must drop out of competition with many other companies of equal aggressiveness, or we must find some course of procedure which would allow us to compete with these companies and which would still appeal to our management, who must needs furnish the money. It must be obvious from the very nature of our business that we cannot manufacture gasoline in a plant which is hauled to our source of supply like a compression test car. It is equally apparent that all of our older plants contain much investment which does not contribute directly to their profitability. However, some compromise be-

*Presented before the convention of the Association of Natural Gasoline Manufacturers, Tulsa, May 24 to 27, 1927.

Why do Leading Refiners Prefer Laclede-Christy Flat Arches?

Because—

1. No loose pieces—entire structure bolted together, making one unit—physically impossible for any section or piece to fall in.
2. Bolted castings provide positive spacing of tile, eliminating strains which are main ceuses of spalling.
3. Easy to erect—photograph above shows simplicity of supporting structure and provision for easy hanging of tile.
4. And last, but not least, Laclede-Christy Arch Tile—the highest grade material for this purpose. Costs no more than ordinary tile.

They Do Last Longer!

Mention Where You Saw the Advertisement

tween these two extremes can be reached. This problem, if I have correctly stated it, seemed to leave only one solution—that we discard precedent and look to each piece of equipment separately to see what could be done to decrease the intangible or lost investment which, considered from the common sense point of view, we wrote off as lost operation expense immediately upon completion and start of operations of any plant.

With this in mind we discussed again with the manufacturer of portable equipment the feasibility of building along the same type of construction as our 2500-gallon units, plants which were capable of commercial operation at the rate of about 10,000 gallons a day. This resulted in the well-known 7500-gallon unit which has been brought out by at least three of the more prominent manufacturers of gasoline equipment. The first thing which came to our attention after the distillation unit was the auxiliary room where we produce electricity, compressed air and pump mineral seal oil and water. We have pumped fluids in, I believe, every conceivable manner. We have electrically driven centrifugal pumps, belt-driven centrifugal pumps, geared pumps, and, in fact, everything but windmills. Some of our oldest plants contain steam pumping equipment and an accurate analysis of their cost records indicated to me that although from the known standpoint of fuel economy and strict mechanical efficiency, the steam pump was far from ideal, yet these same cost records through years of operations proved that the steam was at least as cheap, if not cheaper, than any other means we had. This led me to believe that probably all of our auxiliary equipment could be steam driven and the use of steam-driven auxiliary apparatus certainly lent itself easily to the unit idea in plant construction.

Following along this line of reasoning, we redesigned our engine room and boiler house layouts in connection with the installation of 7500-gallon units, so that each engine and compressor became a complete unit including the gas cooler necessary to the compressor and the water pump necessary for water circulation over both the gas cooler and the engine compressor. From our original auxiliary room equipment this left only starting air and electrical generation to be taken care of. Steam turbine driven generators and direct gas engine driven compressors eliminated these factors. Boilers which had previously, in all of our plants, been ordinary locomotive type were changed to semi-portable water tube units which had greater capacity per unit and which, from the operation standpoint relieved us of one of the largest single sources of trouble in operating on bad water.

Cooling Equipment

Since our water cooling towers were already built and designed to handle the circulation from each of the distillation units, the only thing left to work out was a reasonably efficient highly salvagable system of storage and cooling of water for the engines. While we have not entirely standardized this we have so far used 1600-barrel wood or 2000-barrel iron tanks on 10-foot steel supports with seven-deck portable cooling towers mounted on top of each tank. This system allowed gravity circulation over gas coolers and engines to individual hot wells for each unit from which the unit pump put the water back over the tower and tank. Our final workout of the unit idea is such that around a central hub of the plant is laid the first of each unit of the distillation, boiler, engine, and absorber capacities so that each set of units may be added to unit by unit until desired size is obtained. In practice it has worked out beautifully both from construction and operation standpoints.

I have tried to describe in brief fashion how we have worked out the unit idea in the plant so that it is possible to either expand or contract this plant with varying field conditions up to almost any desired size. Our business is commonly thought of as a producing business. To my mind all of us in the gasoline industry should more properly consider ourselves as manufacturers, since our work is basically that of transporting and converting a raw product into another product which is commercially salable and entirely different from our original one. Therefore, our business is as essentially a manufacturing business as is the manufacture of Ford automobiles from the raw material as produced in the mine, forest, and the ranch. In any manufacturing business, of course, the effort is to take advantage of the raw market to the end that manufacturing operations shall be profitable. Since our raw material is such that it cannot be transported over long distances, let us think a moment about what is happening to the producing industry which furnishes this raw material and what relation this bears to our business as strictly one of manufacture.

Seminole an Example

Probably there is no better example of what I have in mind than the present excitement at Seminole. Here we have all of the conditions which are the reason for the unit idea in gasoline plant construction. We have heavy flush production, giving us an exceedingly high load factor through the early life of the plant; we have the very general use of the gas lift which maintains high peak values of flush production; and we expect to have a very rapid decline which will leave us with possibly 20 to 40 per cent of our present potential gasoline production in two years. In a field like this it seems to me that it must be obvious that we should be prepared to build gasoline plants capable of handling large percentages of this heavy flush, capable also of making a profit on investment during the flush period only; and, in addition, capable of contraction to the expected 20 to 40 per cent of present potential production when necessity for part of the installed equipment no longer exists. For this type of field the unit plant offers efficiency, cheapness and high salvage values. Let us consider these three factors:

In the final analysis, values of efficiency must be comparative, since we cannot state that the production of a gallon of gasoline should require only a certain number of B.t.u.s. In genertal, we may judge operating efficiency from an observation of the following items:

Content of the residue gas.

Relative production, i.e., the plant yield in gallons per 1000 compared to the gasoline content as indicated by standard testing methods.

Overload conditions or actual production compared with the plant rating.

The relation between the heat saved, by use of exchangers, etc., and the total amount of heat that is added to the oil in its circuit of the plant. This is an important factor in fuel economy.

In our case gas tests are made with the standard charcoal absorption apparatus, the distillation being made at atmospheric pressure through a 32-degree Fahrenheit condenser.

We have not observed any appreciable decrease in the operating efficiency on 7500-gallon units for loads as high as 11,000 gallons, or approximately 147 per cent of rated capacity. We have two plants equipped with bubble cap absorbers operating at this rating and stripping the residue to less than 0.05 gallon per 1000.

Heat balances calculated from operating data show from 52 to 58 per cent of the heat used in distilling the gasoline from the oil is returned to the system through the exchangers. Steam consumption varies from seven to 10 pounds per gallon of gasoline consumed by the distillation units not including the steam consumed by the pumps. The water circulation on condensers and oil coolers is usually between 40 and 45 gallons per gallon of gasoline produced.

The figures given are representative of daily operation of the units on a permanent plant basis, for purposes of comparison, and are not submitted as records or for comparison with record achievements in other localities. We are well satisfied with the results we have obtained with the semi-portable unit and we believe that from an operating standpoint they compare more favorably with plants of the permanent type. This leaves two other factors—those of cost and salvability.

Semi-Portable Ahead

Cost is, of course, a variable factor in different organizations. In our case we can only make comparisons as between our own semi-portable operations and our permanent operations where the advantage is somewhat in favor of the semi-portable unit idea. As you go to larger plants this advantage becomes less in favor of the semi-portable unit and in considering a plant which may reasonably be expected to produce say 30,000 gallons a day in a field where development will be slow and the decline in production also slow, there is very little to be said in favor of either plant except that there "ain't any such animal," and very few of us in actual fact are called upon to build plants where the ratio of settled to flush production is high and where we can prophesy with any degree

CORROSION RESISTANT ✓
EROSION RESISTANT ✓
STRENGTH ✓
TOUGHNESS ✓
DENSITY ✓

The combination of properties possessed by Hills-McCanna Alloys are your protection against production losses from shut-downs due to replacements.

A rigid "service test" policy is further assurance against deterioration. Hills-McCanna Alloys must prove themselves in actual service before they are recommended to users. Adherence to this policy is reflected by the world-wide acceptance of our product.

Come to us for castings or advice. Our engineers are ready to go into your problem and produce. To Standardize is to Hills-McCanna-ize.

HILLS-McCANNA CO.
2029 ELSTON AVENUE CHICAGO
Founders of Non-Ferrous Alloys Since 1870

of real accuracy that we will have a certain gallonage over a three-year period.

To those of us who have been compelled to dismantle and more the older type of permanent plant the loss in salvage is well known. The factory assembled plant on the other hand moves with practically no salvage loss other than the labor involved in the actual set up and dismantling of the plant. The only concrete we have found necessary is a concrete setting for our elevated water tanks and for the engines. By using engines in units of large horsepower we have decreased the number of foundations to the minimum. There are, of course, some other small items of concrete construction such as absorber settings but they are all of such type that complicated form work is unnecessary. Since all of our water cooling equipment is portable in the sense that it can be completely dismantled and moved and since this applies also to the boilers, distillation units, tankage and all of the buildings including the employes dwellings, these plants are in reality 100 per cent salvable.

There is another thought in connection with the unit plant which I have not touched upon. Standardization has attracted all of us in the oil industry during the last two years particularly. I know of no system of plant construction which admits of as thorough standardization as this so-called unit idea built around the factory assembled plant. I know that in our case we find it practical to carry in warehouse stock enough of our standardized material to construct a complete gasoline plant.

This fact alone has permitted us greater speed in construction, with consequent high return from flush production. It has permitted us to have a highly trained force in our construction department familiar with all of our standardized layouts and able, therefore, to build complete plants which make production efficiently on their first day's operation. As a corallary, it has aided our operating division by permitting us to move operating forces from one plant to another without consequent loss of efficiency in production which usually follows while familiarizing new crews with operating cycles to which they were not accustomed: it has reduced our overhead in design work, and has particularly helped the liaison between our warehouse department and our construction and operation departments through entire standardization and consequent ability to handle material speedily.

First Ideas Wrong

Here I would like to digress long enough to state my conviction that a great deal of the odium which has attached to the portable plant has been a misconception of its use, of its actual working, and of its efficiency. I well remember that at a recent meeting of the Association of Natural Gasoline Manufacturers my company along with others came in for a large share of criticism and ridicule in its use of the portable plant. It was then stated and probably was the honest conviction of a number of our members, that the so-called portable plant was going to make it possible for the small independent producer to compete with what we in the larger companies are prone to consider our divine right to dominate the natural gasoline industry. It was thought then by many members of this association that the use of the portable plant would point the way for each producer to build a plant to handle the production from his own lease and that it foretold the inevitable decline and fall of the gasoline industry as we then knew it, which depended for its profits upon large scale operations and which coupled into and complemented our refinery and pipe line operations. I believe the evidence of the last year indicates without question that this is not the case and that the natural gasoline industry must and always will remain in the hands of the organizations best equipped to handle it by virtue of their trained staffs of construction and operation men and their pipe line, refining, and marketing facilities.

The portable plant or unit idea in gasoline plant construction brings no millennium (unfortunately). We are still faced with the ever recurring problems which come up with all gasoline departments but it has greatly simplified two of the most troublesome things we have to consider; one, the layout, design and construction of plants with their delays and hitches; the other—elimination of much of the risk in attacking new fields with plants because of the very high salvage value of all equipment. I know in my own case these two things under the old scheme of plant design were my greatest mental hazards. In eliminating them I have vastly simplified and made more pleasant my own work, besides, I believe, making profits for my company which otherwise would have been lost.

Gasoline Plant Lubrication*

By E. R. LEDERER, O. S. WYATT and F. R. STALEY
Of The Texas Pacific Coal and Oil Company

EFFICIENT lubrication is an essential for good and economical operation in natural gasoline plants as in any other industry which depends largely on the uninterrupted, efficient and low cost operation of its machinery.

The past few years have brought the importance of good lubrication more and more to the foreground. The former practice that any lubricating oil was satisfactory as long as it met certain tests and was cheap, has been discarded. Refinery concerns, which expect to stay in the market, sell their oils today on quality and performance, rather than on price; their trained "lubricating engineers" make a careful and thorough study of each individual plant and engine, use scientific instruments and methods to check the operations of each piece of machinery and make—in co-operation with well equipped refinery laboratories—a complete survey of a plant before they recommend the most suitable oil for the service, and guesswork is, therefore, eliminated. Such reliable concerns give now the same service on their lubricating oils as large manufacturers of motors, pumps, compressors and other machinery, furnish to protect their products and their reputation.

Lubricating oils are made at present from many different crudes and by widely different refining methods; only an experienced engineer is capable to recommend the best oil for a given machine and for the particular conditions under which it is operated.

Essential Qualities

In general, Thomsen states that the lubricant must possess the following qualities:

1. Sufficient viscosity and oiliness to suit the mechanical conditions and the conditions of speed, pressure and temperature. Too little oiliness means excess wear and friction, to high a viscosity means loss of power.

2. It must suit the lubricating system designed for the individual machine.

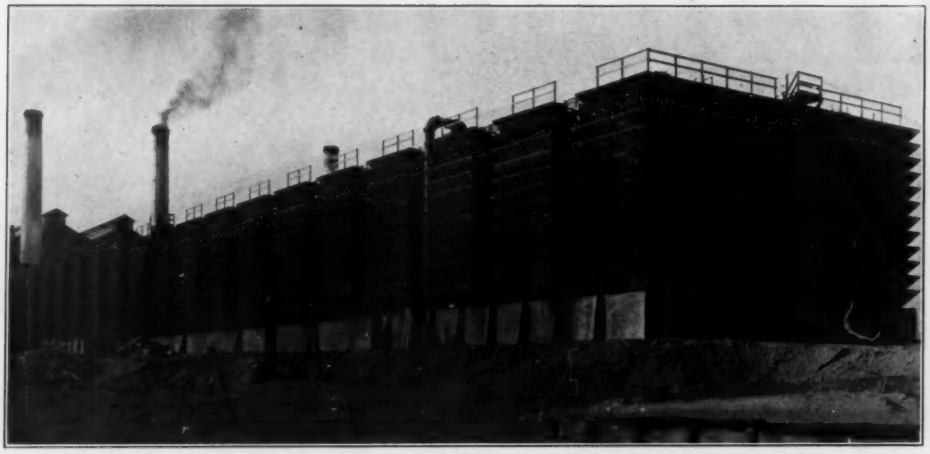
3. It must not produce—or at least form only a minimum of—deposits during use, when exposed to air, gas, water, dust or other impurities with which the oil must come in contact in performing its duty.

4. The oil must meet the particular physical and chemical tests necessary for the class of work it is to perform.

After the correct oil is found for a given machine, it is necessary that the new supply will run uniform and as nearly constant and economical in its properties at all times; when a lubricator is set for a satisfactory oil feed and a new supply of oil is received, and it varies in its properties from the previous oil used, the lubricator will feed too fast and waste oil, or feed too slow and allow the bearings to run hot. It is, therefore, important that the refiner supplies a product that is always uniform within specified ranges.

Gas engine lubrication deposits may be found on the valves, cylinders and piston rings of the combustion cylinder. They may be formed by dirt and dust from

*Presented by Dr. E. R. Lederer before the annual convention of the Association of Natural Gasoline Manufacturers, Tulsa, May 24 to 27, 1927.



Highest in Quality and Economy

In spite of the fact that Fluor Redwood Cooling Towers are made of the finest materials and embrace the best construction, bear in mind that our quantity production system keeps the price below that of all other high grade towers of equal capacities and performance. You may as well have the best when the best is lower in first cost as well as more economical eventually.

Ingenious mechanical design permits using the same integral parts for assembling a wide range of sizes, thereby offering a wide choice of heights and widths to meet unusual conditions. Let us submit the recommendations of our engineers covering your requirements.

Fluor Construction Company

Constructors and Engineers

909 E. 59th St.,
Los Angeles, Calif.

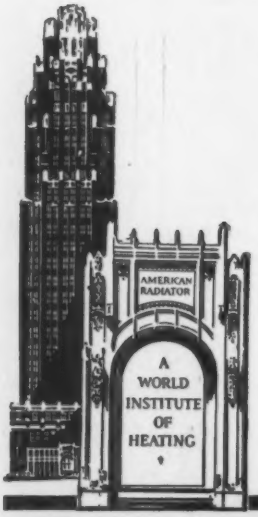
Kennedy Bldg.,
Tulsa, Okla.

FLUOR REDWOOD COOLING TOWERS

Announcing—

NEW 15-Acre Foundry and *New* ARCO Metal for Our Standard Products and the Special Products of Our Clients

To Our Patrons in the Petroleum Industry:



It gives us genuine pleasure to announce to our friends and patrons in the Petroleum Industry, the acquisition by our Company of a new fifteen-acre foundry, with machine shop, at Springfield, Illinois, for the production of our new Arco Metal and Arco Metal Products.

To our clients in the Petroleum Industry, we believe this announcement will be of supreme interest. The development of our new Arco Metal represents, truly, a milestone in the industry; and the acquisition of the new, modernly equipped fifteen-acre foundry plant enables us to produce this superior metal in quantity not only for our own regular products, but for the special products of our clients.

We trust that our patrons will accept this announcement as another manifestation of our earnest desire to serve the progress of the industry and the interest of each of its members.

Faithfully,

AMERICAN RADIATOR COMPANY

AMERICAN RADIATOR

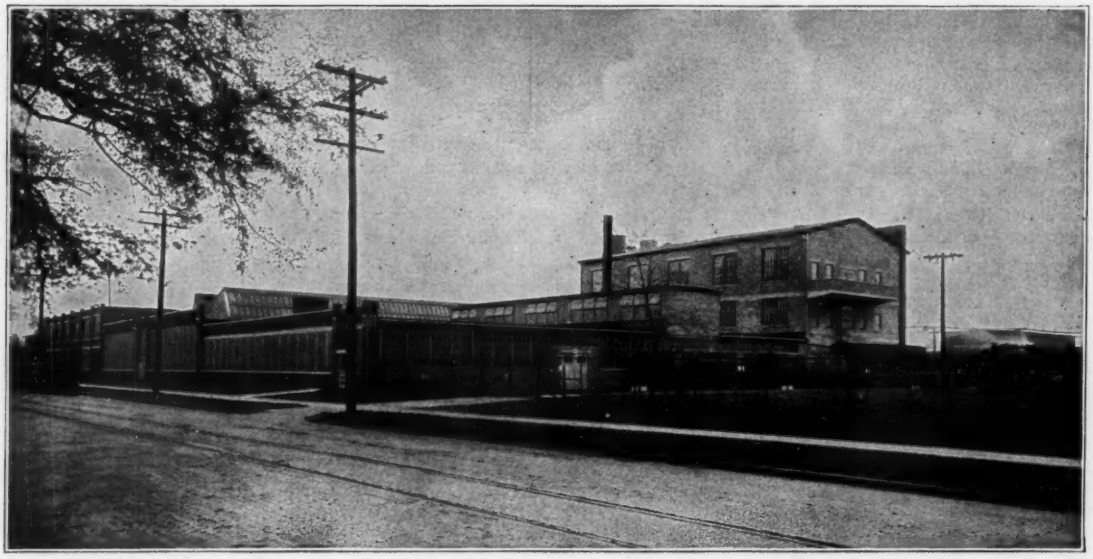
Industrial

40 West 40th Street
NEW YORK, N. Y.

1807 Elmwood Avenue
BUFFALO, N. Y.

816 South Michigan Avenue
CHICAGO, ILL.

Mention Where You Saw the Advertisement



ARCO METAL

The development of our new Arco Metal solves one of the industry's oldest and greatest problems. It is the final result of many years of study, testing and refining in our research laboratories. It is an iron offering high resistance to corrosion, of exceeding density and strength, allowing for easy and precise machining, and insuring uniform thickness of metal wall. Test installations in the Amarillo Field have conclusively demonstrated that the new Arco Metal is far more enduring than older types of condensing units.

Complete Modern Equipment to Serve the Special Requirements of Our Clients

Our fifteen-acre Springfield Plant has been modernly equipped in every respect to produce not only our own Standard Products, but to meet the demands of our clients for Special Castings, either on the basis of our preparing pattern equipment or the equipment being furnished by our client.

Special Mix Guaranteed Every Day

A feature of real significance in connection with the opening of the new Springfield Plant is the fact that our special Arco Metal pre-determined mix will be poured every day, insuring the very highest quality.

Our Field Organization Is Yours
Estimates Freely and Gladly Given

We are eager to serve you. Let us know your general requirements or specifications. Just wire or 'phone, at our expense, and a representative will promptly call.

COMPANY

Division D

935 Kennedy Bldg.
TULSA, OKLA.

1214 Quinby Bldg.
LOS ANGELES, CALIF.

Our Standard Products:

Sterling Oil Condensing Sections
Sterling Oil Cooling Sections
Sterling Oil Accessories
Sterling Bubble Caps

the air, incomplete combustion, over lubrication or an inferior grade of oil, containing impurities or having a high carbon content.

Frictional Loss

Thomsen states that the frictional losses in a medium size gas engine range from 15 to 30 per cent, and in a large one from 10 to 20 per cent of the rated horsepower; this is constant and independent of the actual engine load. It is easy to waste 5 to 10 per cent of the engine power by unsuitable lubricating oils. Fresh oil only should be used for piston lubrication.

Waste oil from bearings should be collected and if restored and purified in a good filter, can be used again on bearings.

In general the object of lubrication of a gas engine is to provide clean and efficient lubrication to all parts.

The selection of the proper lubricant for a given machine is, therefore, very important and the coustomary routine tests to determine flash, fire, viscosity, etc., are not sufficient. Viscosity, of course, is in a certain way a measure for the lubricating value of an oil; however, oils of the same viscosity at a given temperature but made from different crudes might differ in lubricating value and efficiency in the same engine. Other tests are necessary to make sure an oil will suit local and individual operating conditions, like carbon tests, volatility, heat test, emulsion test, acidity, etc.

Complicated mechanical apparatus has been devised for mechanical testing of lubricants, in order to match or approach actual operating conditions under which the oil has to stand up.

It is not within the scope of this paper to go into details of this work. We mention it here only to show you that a great deal of study and thought is given the question of a proper lubricant for your engines, and that skilled chemists and engineers are working out for you your lubricating problems.

Gasoline Plant Lubrication

There are four principal classes of lubrication encountered in natural gasoline plants, i.e.:

1. Power cylinder lubrication of internal combustion engines.
2. Crank case lubrication.
3. Gas compressor cylinder lubrication.
4. Lubrication of auxiliaries such as pumping, equipment, electric motors, generators, etc.

In power cylinder lubrication we get almost entirely away from the fuel complex because natural gas is universally used for fuel. Our main problem here is selecting an oil most suitable for the type of engine in use, its mechanical condition, the load factor under which it is working and its cooling system conditions. There is such a nenormous variation in these four conditions just mentioned that each plant must be carefully studied and its individual recommendation worked out.

For instance, in a 2-cycle engine there is a working stroke every revolution, whereas in a 4-cicle engine there is a working stroke every other revolution; therefore, the rate of heat-transfer from the inside of the cylinder to the cooling water must be twice as rapid in a 2-cycle as in a 4-cycle engine to maintain the same piston, ring and internal cylinder wall temperature. Also, if there is no cooling water treating plant and the cooling water is hard and scales badly, this scale will cut down the rate of heat transfer resulting in higher cylinder temperatures and frequently necessitates the use of a heavier oil than would be necessary if soft water or treated water was used. If cylinders, pistons and rings are badly worn, a heavier oil must be used to give a better seal, also (in case of vertical engines) to cushion the piston slap.

In certain makes and types of 2-cycle engines, water in the form of vapor is injected with the fuel charge in an effort to retard the burning rate of the fuel and obtain a steam expansion effect, also to reduce the hammer-blow effect of the explosion. Where this water-injection is used, better lubrication results can sometimes be obtained by using an oil compounded with about 5 per cent of acidless tallow; this for the same reason that we compound steam cylinder oils.

The carbon residue of internal combustion cylinder oils should be as low as possible. Experience has proven that the lightest bodied oil which will maintain a constant lubricating film under a given set of operating conditions is the best and most economical to use. If too heavy an oil is used excessive "carbon" deposits under rings, on piston and cylinder heads, and (in case of 4-cylinder engines) on valves, will be formed and the engine will run hotter.

Crank Case

In crank case and bearing lubrication also the lightest oil which will maintain the proper lubricating film should be used, for increase in viscosity means increase in fluid friction and any increase in either fluid or solid friction means loss of power and increase in heat generation, which is just what we want to avoid.

Too much clearance in crosshead and crankpin bearings is almost as great an evil as too little clearance, for anyone can demonstrate that a horseshoe can be heated red hot by laying it on an anvil and striking it rapidly with a hammer.

Heavy duty engine crank cases should be equipped with continuous circulating filtration and cooling systems. Such systems will pay dividends where large quantities of oil are used.

Air or gas compressors should be lubricated with a light or medium bodied oil, fed sparingly, except where excessively wet gas is being handled. Generally, we find that single and two stage compressors handling gas from the gathering lines to the wells can be satisfactorily lubricated with a good quality paraffin base oil with a viscosity of 300 to 350 seconds to 100 degrees Fahrenheit. We have found some two-stage compressors handling vapors from the weathering tanks and recovery plants discharging at high pressure, that had to have a 750 viscosity oil fed 12 to 18 drops per minute per cylinder. Ordinarily 3 to 7 drops per minute per cylinder will do the work.

Use of Forced Feed

Mechanical forced-feed lubrication only should be used for power and compressor cylinders.

The proper crank case oil level should be determined and rigidly maintained. Too much oil in the crank case will shorten the life of the oil; too little will surely burn the bearings up.

Where high speed auxiliaries such as turbine or motor driven centrifugal pumps are used, 200 viscosity oil will usually give a lower bearing temperature than heavier oils, provided, of course, that bearings are in line and in good condition.

As previously stated, no set rules can be laid down as to just what oils will satisfactorily lubricate any certain make of engine, because of varying operating, mechanical and load conditions, but take a new engine of the usual type, properly built, installed, cooled and properly operated and maintained, a good quality paraffin base oil of 300 to 350 seconds viscosity, or asphalt base oil of 500 to 550 seconds viscosity properly fed should give good results. The viscosity of these two oils mentioned will be practically the same at 210 degrees Fahrenheit.

Continental Improves Wichita Falls Plant

Wichita Falls.—The Continental Refining Company has recently completed an improvement program which consisted of the installation of bubble type fractionating columns of company design, place on the crude still battery. The four Dubbs cracking units have been equipped with two expansion chambers per unit with which they are enabled to make longer runs. The refinery has also begun using gas for fuel in all departments through a connection with the industrial gas line transporting natural gas from the Panhandle of Texas.

Building Gasoline Plant At Cotton Valley

Shreveport, La.—The Louisiana Oil & Refining Corporation has contracted for a quantity of natural gas in the Cotton Valley field from the Woodley Petroleum Company, and will build a high pressure absorption plant to handle about 10,000,000 cubic feet of gas daily. This gas offers a yield of about one-half gallon per thousand cubic feet. A plant formerly used in connection with a crude refinery is being dismantled and moved to the Cotton Valley field, and only a small amount of new equipment will be needed.

Now!
you need *the*
CHARCOAL
Process of Gasoline Recovery
to keep
operating
at a
profit

GASOLINE RECOVERY CORPORATION

Charleston, W. Va.

TULSA
423 Wright Bldg.

LONG BEACH
Box 321

Mention Where You Saw the Advertisement

Water Treatment in Natural Gasoline Manufacture*

By F. B. GOOD
The Texas Company, Breckenridge, Texas

THE modern treater consists of a large cylindrical steel tank; in the center of which is a conical tube or downtake, open at the bottom and of sufficient size to retain the water during the mixing period of from 45 to 55 minutes, according to the volume. The chemicals and the raw water being mixed at the top of this tube in definite proportions continuously. The conical form of the downtake impedes the flow of water, allowing the precipitate to settle as a sludge, and is flushed away through a valve, the water continuing on its way upward through a series of baffles, which knock and retain more of the precipitate, to the filter where the last of the flocculent sediment is removed, the water passing out from the filter soft and clear, ready for distribution.

The types of these treaters vary. Some are conical, others have flat bottoms, with perforated pipes for flushing the sludge away. They also have a number of very ingenious devices for proportioning the flow of chemicals to the flow of water.

These consist of the weir or orifice proportioning with variable feed.

Water motors operated by pump pressure, depending upon comparative cylinder displacement ratio.

Constant raw water control with constant chemical feed, tipping bucket and a number of other devices, all of which can be made to give satisfactory service, when given the proper supervision. In fact you can accomplish almost any desired results with one of these plants. The plant I have in mind was designed for 9,000-gallon-hour capacity, and has been treating 12,000 gallons an hour very successfully for the past six years, the raw and treated water having the following analysis:

Raw Water

	Parts per Million	Grains per Gallon
Suspended matter	4.0	0.23
Total solids	418.0	24.25
Silica	14.0	.81
Iron and alumina	1.0	....
Consisting of the ions of—		
Calcium	179.8	
Magnesium	41.5	
Sodium	44.9	
Bicorbonate	145.2	
Sulphate	125.2	
Chloride	5.2	
Hypothetically combined—		
Calcium bi-carbonate	179.8	10.42
Magnesium bicorbonate	41.5	2.40
Megnesium sulphate	128.0	7.48
Sodium chloride	8.6	0.50
Silica	14.0	0.81
Iron and alumnia	00.0	0.00
After treatment—		
Mono-carbonate alkalinity	14.0	0.8
Bi-carbonate alkalinity	4.0	0.2
Caustic alkalinity	0.0	0.0
Salt	8.6	0.5
Silica	4.0	0.2

*Read before annual convention of the Association of Natural Gasoline Manufacturers, Tulsa, May 24 to 27.

It is obvious from the above analysis of the raw water that it contains approximately 3½ pounds of scale-forming solid per 1,000 gallons of water, these solids being reduced by treatment to less than one-fourth pound to 1,000 gallons of water. If we take the data proposed by some authorities we will find they claim that, for every pound of scale-forming matter removed from the water, you save 13 cents per pound in fuel and boiler efficiency alone, not taking into consideration the intangible saving from the loss of production and from pipe corrosion. If we accept these results we will find that in the above water the company has saved in boiler and fuel alone $121.68 per day or $44,414.20 per year, at a total cost of chemicals for treatment of $6 per day or $2,190 per year. During this period they have not had to boil out an engine jacket with acid or lost one from scale formation. At the same time the water used by them is a split water, not having sufficient capacity to treat the entire volume of water pumped.

The next treatment taken into consideration, which I consider very bad form, but must universally employed at the present time, is the compounds. They are much better than no treatment at all, and there is no doubt but what they have a tendency to prolong the life of your flues, and efficiency to fuel consumed, there being a compound made for every known condition existing in water. For your information I will select two and give you their analysis, from which you can draw your own conclusions:

	Per Cent
No. 1 Compound	
Water	57.91
Sodium carbonate	4.73
Sodium silicate	33.13
Caustic soda	1.03
Undetermined	2.93
No. 2 Compound	
Water	35.27
Sodium carbonate	36.23
Starch	6.05
Sodium phospate	7.25
Sodium chloride	Trace
Sodium oxide	5.77
Caustic soda	2.30
Sodium chromate	2.30
Mercury	5.55
Kerosene	Trace

Reactions in Treater

Reactions occurring in the treater, the same being applied to the boiler compounds when composed of the same compound coming in contact with the same substances.

Sodium carbonate plus aluminum sulphate equal sodium sulphate plus aluminum hydrate, plus carbon dioxide, plus water. $3Na_2CO_3+Al_2(SO_4)_3=3NaSO_4+Al_2(OH)_6+CO_2+H_2O$.

Sodium carbonate plus calcium hydrate equal sodium hydrate plus calcium carbonate. $Na_2CO_3+Ca(OH)_2=2NaOH+CaCO_3$.

Sodium carbonate plus calcium chloride equal sodium chloride plus calcium carbonate. $Na_2CO_3+CaCl=2NaCl+CaCO_3$.

Sodium carbonate plus carbon dioxide plus water equal sodium bi-carbonate. $Na_2CO_3+CO_2+H_2O=2NaHCO_3$.

Sodium carbonate plus magnesium sulphate equal sodium sulphate plus magnesium carbonate. $Na_2CO_3+MgSO_4=Na_2SO_4+MgCO_3$.

Sodium carbonate plus sulphuric acid equal sodium sulphate plus carbon dioxide plus water. $Na_2CO_3+H_2SO_4=Na_2SO_4+CO_2+H_2O$.

Calcium hydrate plus carbon dioxide equal calcium carbonate plus water. $Ca(OH)_2+CO_2=CaCO_3+H_2O$.

Calcium hydrate plus carbon dioxide equal calcium bi-carbonate. $Ca(OH)_2+2CO_2=CaH_2(CO_3)_2$.

Calcium hydrate plus calcium bicarbonate equal calcium mono-carbonate plus water. $Ca(OH)_2+CaH_2(CO_3)_2=2CaCO_3+H_2O$.

Calcium hydrate plus ferrous sulphate plus water equal calcium sulphate plus ferrous hydrate plus water. $Ca(OH)_2+FeSO_4+H_2O=CaSO_4+Fe(OH)_2+H_2O$.

Calcium hydrate plus hydrochloric acid equal calcium chloride plus water. $Ca(OH)_2+2HCl=CaCl_2+2H_2O$.

Calcium hydrate plus magnesium mono-carbonate equal calcium carbonate plus magnesium hydrate. $Ca(OH)_2+MgCO_3=CaCO_3+Mg(OH)_2$.

Calcium hydrate plus magnesium bicarbonate equal calcium carbonate plus magnesium mono-carbonate. $Ca(OH)_2+MgH_2(CO_3)_2=CaCO_3+MgCO_3$.

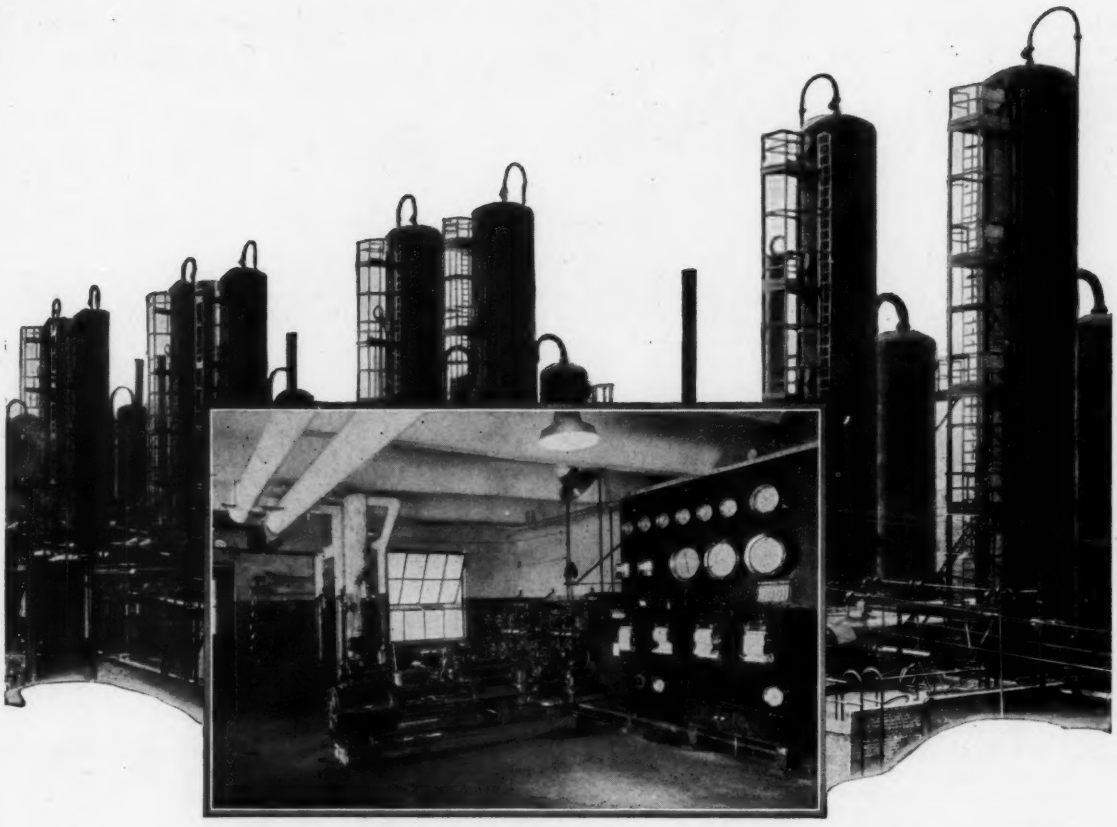
Aluminum sulphate plus calcium oxide equals aluminum hydrate plus calcium sulphate plus water. $Al_2(SO_4)_3+18H_2O+CaO=Al_2(OH)_6+3CaSO_4+15H_2O$.

Aluminum sulphate plus magnesium carbonate equal aluminum hydrate plus magnesium sulphate plus water. $Al_2SO_4+18H_2O+MgCo_3=Al_2(OH)_6+MgSO_4+15H_2O$.

Aluminum sulphate plus calcium mono-carbonate equal aluminum hydrate plus calcium sulphate plus water. $A^1{}_2SO_4+18H_2O+CaCO_3=Al_2(OH)_6+3CaSO_4+H_2O$.

Action of Compounds

The above represent a few of the most important reactions taking place in the treater, and with the compounds they continue as follows: The caustic soda precipitates the carbonates of lime



LOOMING UP!

Refiners today not only utilize control—they capitalize it

The principle of AUTOMATIC Still and Tower Temperature CONTROL is rapidly looming into general recognition as a basic requisite of refining economy.

It is not only recognized but *capitalized*.

Engineering data from Brown Automatic Control installations provide a valuable basis for determination of a suitable automatic control equipment for your plant.

Draw on our experience. Get catalog No. 15. THE BROWN INSTRUMENT CO., 4413 Wayne Ave., PHILADELPHIA, PA. Branch offices in 18 principal cities.

Pyrometers
Automatic Temperature and Pressure Controls
Flow Meters
Recorders
CO. Meters
Pressure Gauges
Vacuum Gauges
Liquid Level Gauges
Draft Gauges
Thermometers
Tachometers
Hygrometers

Brown Automatic Temperature Control

"To Measure is to Economize"—*Pascal.*

Mention Where You Saw the Advertisement

and in doing so the carbonate of soda is formed which in turn combines with the sulphates of lime forming the sulphate of soda which is harmless. The sodium silicate functions in the same manner only it is colloidal in nature, which has a tendency to prevent the scale from adhering to the tubes and plates. Sodium phosphate is also used in decomposing the sulphates of lime and magnesium, it forming the sulphates of sodium and the phosphates of lime and magnesium. The former remains soluble and is harmless, the latter being deposited in the form of loose crystals. Phosphates also act on the carbonates of lime and magnesium, forming phosphates of them, and at the same time neutralizing the carbolic acid released, the sulphuric being released as a sulphate. Mercury also plays an important duty, especially in waters high in magnesium chloride, which is very corrosive in action. It combines forming mercuric chloride which is precipitated; it will also form an amalgam on the sheets and flues preventing adhesion of incrustations. Kerosene is also supposed to have the faculty of penetrating this scale, preventing it from adhering to the tubes. Those of you who are acquainted with the flotation of ores know that globules of oil will adhere to the sulphates bringing them to the surface. The same applies when kerosene is inserted in a boiler; it adheres to the sulphates preventing them from sticking to the tubes and can be blown off. We can size up all our water troubles and cures as follows:

Trouble—

Cause: Chlorides or sulphates of magnesium, sugars and acids; cure, soda ash. Cause: Dissolved carbonic acid and oxygen; cure, lime, caustic soda and heating.

Corrosion—

Cause: Electrolytic action; cure, zinc plates (only in absence of oxygen.) Cause: Bicarbonates of lime, iron and magnesium; cure, heating feed water, caustic soda lime. Cause: Organic matter; cure, soda ash.

Incrustation—

Cause: Sulphates; cure, soda ash. Cause: Organic matter; cure, alum and filter.

Carbonates Formed

We find upon the examination of our gas engine jackets a deposit in which the carbonates are predominating. These carbonates are commonly found as limestone or marble; they are not soluble in pure water but are soluble in a water containing free acid. After they are once in solution and a temperature of 200 degrees applied, they are precipitated as common carbonates forming a scale. Whereas it takes a temperature of 290 degrees to precipitate sulphates; this compares to a boiler pressure of about 45 pounds, consequently the gas engine jacket does not reach sufficient temperature for their formation. While in the compressor you will not find either a sulphate or carbonate formation but a formation of algea, which has gone through the temperature of this machine, it changing slightly in looks, but upon examination with a glass you will find it still retains resemblance to your so-called moss. This nuisance can be removed by the use of copper sulphate in quantities of five parts of copper sulphate to the 1,000,000 parts of water, and a stronger solution would not hurt if the water is not to be used for drinking. Chlorine also is supposed to have the same property for the destruction of algea; this can be obtained in the form of calcium chloride. It has about 35 per cent of available chlorine.

Results

I have an analysis of water from a coil pit, and have reason to believe that this is a fair sample of the condition existing in the great majority of them. Such conditions seem unbelievable in this modern time when elimination of such can be made at such moderate cost, compared to the destruction that such water as this will create. The water analysis was as follows: Solid water 285½ grain, a little over 3½ grains of solid matter in suspension, and nearly 20 grains of free acid per United States gallon of 231 cubic inches. Such an acid condition in any water coming in contact with surfaces will cause a corrosion internally or externally that will destroy it years before its time under ordinary conditions.

Comparing conditions existing in the same water, before and after treatment, here are two samples of scale taken from the same water. One of them was obtained from a boiler having 30 day's service and using compounds; the other was taken from a boiler that had seen 75 days of service. Notice the difference: The boiler with treated water scale is a soft mass that can be powdered in the fingers and the untreated boiler scale is a hard compact mass that is very difficult of removal.

Due to impure water, summed up, we have scale formation in the jackets of the engine cylinders, scale formation on the tubes of the boilers, plus corrosion of steam piping, particularly where live steam is introduced into the steam still, and the so-called separating tanks off the fire still. These troubles by themselves bring about an excessive maintenance cost. Collectively they are prohibitive when we have in mind that a treating plant could be installed at a very nominal cost, with what materials usually found around a gasoline plant, that would eliminate most of these troubles. We may safely say that gasoline ultimately will have its water treated, and in that way eliminate the most of these accumulative troubles.

Phillips Builds Another Gasoline Unit

Amarillo, Texas.—On June 1 the Phillips Petroleum Company started construction of its sixth large natural gasoline plant in the Panhandle area of Texas. The new plant will be located in the Sanford-Paramount Pool, which is in the south part of Hutchinson County. The location is section 82, block 46 of the H. & T. C. survey. This plant will be constructed on the unit plan in order that more units for its expansion may be easily constructed as part of the plant as the gas supply becomes available through future drilling. The new plant will have a capacity of 30,000,000 cubic feet of gas daily, and it is planned to put the plant in operation by September 1.

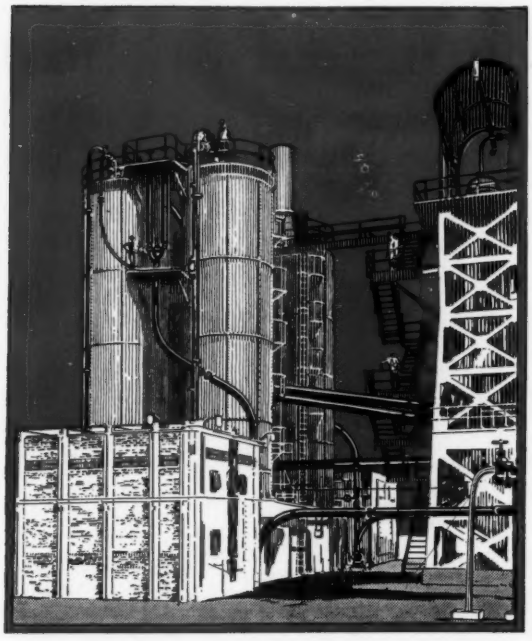
This installation will bring the Phillips Petroleum Corporation up to about 200,000 gallons daily. Phillips has five main plants in the territory at present, four of which are in operation in Hutchinson County, and one in Carson County. The five plants at present in operation have a combined total capacity of around 180,000 gallons daily.

Sinclair Builds Another Plant at Seminole

Tulsa.—The Sinclair Oil & Gas Company is expanding its program of natural gasoline manufacture in the greater Seminole area by the construction of a new gasoline plant in the Bowlegs sector. The new installation will be in section 10-8-6, about two miles south of another large plant which has been in operation for the past several weeks. The new plant will have a capacity of 18,000,000 cubic feet daily, and will consist of 14 units. It is planned to have the first units in operation by July 1 and to have the plant fully completed by September 1. The natural gasoline department of the Sinclair Oil & Gas Company plant to have a total production of 200,000 gallons of gasoline daily by the end of the year.

Phillips Building Fourth Plant in Young County

Graham, Texas. — Phillips Petroleum Company has started construction work on a natural gasoline plant to handle the heavy volume of gas furnished by 3900-foot oil producers in the Stovall-McCluskey section of the South Bend field, Young County. The plant is being erected on the E. C. Stovall farm, James Tobin survey, to handle 15,000,000 cubic feet of gas daily through the charcoal process. The gas in this area averages about one gallon per thousand cubic feet, with a substantial gain in yield when the gas pressure recedes. This new plant will be the fourth for Phillips Petroleum Company in the county.



"Piping *by* Midwest"
--- it's significance

WHEN you place your order for "Piping by Midwest," you rely upon a company that has the facilities and organization to do the work quickly and efficiently, whether it be a small coil, a carload of bends and headers, or all the fabricated piping required for a large oil refinery.

You are assured prompt attention, intelligent interpretation of drawings and specifications, and fabrication in accordance with the most modern practices. Each order is the most important order in the shop—that is the Midwest attitude.

Competent engineering service is available for the solution of any piping problem. Frequently this service has resulted in simplification of piping design and substantial cost reductions.

You are benefiting by the experiences of an organization that has made definite contributions to the development of refinery piping, and is habitually alert for opportunities to better serve the users of fabricated piping.

Bulletin S-5 will tell you more about Midwest Piping Service.

MIDWEST PIPING & SUPPLY COMPANY

Second and Miller Streets, SAINT LOUIS, MISSOURI

Chicago Office: 208 S. LaSalle St. **Tulsa Office: 805 Mayo Bldg.**

Fabricators of Oil Refinery, Natural Gasoline Plant and Power Piping

MIDWEST Piping Service

Mention Where You Saw the Advertisement

Vacuum at Burkburnett

Read before the plant operators meeting of the Association of Natural Gasoline Manufacturers at Wichita Falls

By M. V. ENRIGHT
Supt. Skelly Oil Company, Burkburnett

IN dealing with this subject the word vacuum, as understood by the natural gasoline fraternity, is that of a partial vacuum or any minus pressure below atmospheric pressure. The true meaning of the word vacuum is a void, a vacuity, a space where no material substance exists. A perfect vacuum has never been obtained and probably never will be.

It seems to be the impression in certain quarters that the placing of a vacuum on oil wells is an outgrowth of the natural gasoline industry, but this is not a fact, as vacuum has been used in the oil fields such as Venango and Butler Counties, Pennsylvania, by means of beam pumps, for something like 40 years. The manufacture of natural gasoline started only a few years ago; to be exact, the first successful plant was in West Virginia about 1903. The use of this means of stimulating the oil flow to the wells, while the reverse of restoring pressure on the sand by means of air, gas, or water floods, has the same end in view—increasing the oil production.

It is just possible that no other field has gone as far as Burkburnett in the maximum vacuum exerted on the wells. I know of several plants in this district where a vacuum of 28 inches, based on a normal barometer of 29.30, elevation approximately 1000 feet above sea level, is being maintained at scrubber tanks on incoming lines to plants. It is my opinion that the use of a spring gauge should be discarded as it is inaccurate. It is common practice to use only the mercury "U" tube in vacuum determination. It is also necessary that a plant be equipped with an accurate barometer, as the range of barometric pressure here is from 28.40 to 29.70 and I believe I am correct when I say that the Weather Bureau has reported in this immediate locality a low of 28.30. It is now evident that in checking up the vacuum on a plant or casinghead it will be quite necessary to consult the barometer.

Essential Equipment

It will no doubt be of interest to those who are not actually connected with, or charged with the responsibility of maintaining this abnormally high efficiency, to know what means or effort is required to that end. Starting from the plans for a vacuum installation, a selection must necessarily be made of a standard vacuum pump of the proper size to handle the predetermined volume of gas, as well as a careful calculation of the necessary horsepower required to operate the unit. Consideration of the vacuum pump as well as the power unit to operate the pump is sure to be made, for it is necessary to guarantee the operation of this machinery 24 hours of the day, 365 days of the year. A vacuum such as that maintained in this district will not permit of shutting down on every little pretext and taking any old time to start up. Spare parts for vacuum pump and power unit must be on hand and ready to install without delay.

It is imperative that proper scrubber tanks be placed at the plant on incoming lines to vacuum pumps in order to protect machines from rust and grit. A vacuum on the discharge of vacuum pumps of from eight to 16 inches is ordinarily maintained.

In preparing new pumps for starting, owing to the fact that the cylinders as well as pistons, piston rings, rods, and valves have been protected with No-Oxide and other rust preventatives, it is necessary to pull pistons and valves and thoroughly clean parts before starting up. Valves should be tested with gasoline to know they are tight before replacing.

Check Necessary

In the routine of plant operation it is necessary frequently to check each vacuum cylinder against a closed intake gate valve to know that the individual cylinder is doing its work. A broken or leaky intake or discharge valve can quickly be detected in this manner.

The average manufacturer's guarantee on new machines is that they will test up to within five-tenths of an inch of the barometer against a closed suction. We have recently started a 27x 16 Duplex Vacuum Pump that checked out within three-tenths of the barometer.

The piston rod packing is another fruitful source of trouble, not alone from the standpoint of poor pump efficiency, but a loss of gasoline production from air infiltration. I take it that this matter of air infiltration troubles into the vacuum system will be treated separately at this meeting, as it is an ever present source of trouble for the plant; and it is again evident that the amount of vacuum that is exerted in the field is going to hinge on the air percentage in the total amount of gas handled by the pump. This not only is important from the standpoint of plant efficiency, but also from the angle of plant safety.

With a compression plant maintaining up to 250 pounds pressure on the high compressors, it is evident that there is a constant source of danger present from air percentage creeping up to an explosive mixture. Again, as residue from the plant is ordinarily used to operate the gas engines in the plant as well as the powers and engines of the field, it is quite necessary to keep the air percentage down, as 20 per cent of air in the incoming gas to the plant will result in around 55 per cent air in the residue. These figures are based on gas in the Burkburnett district.

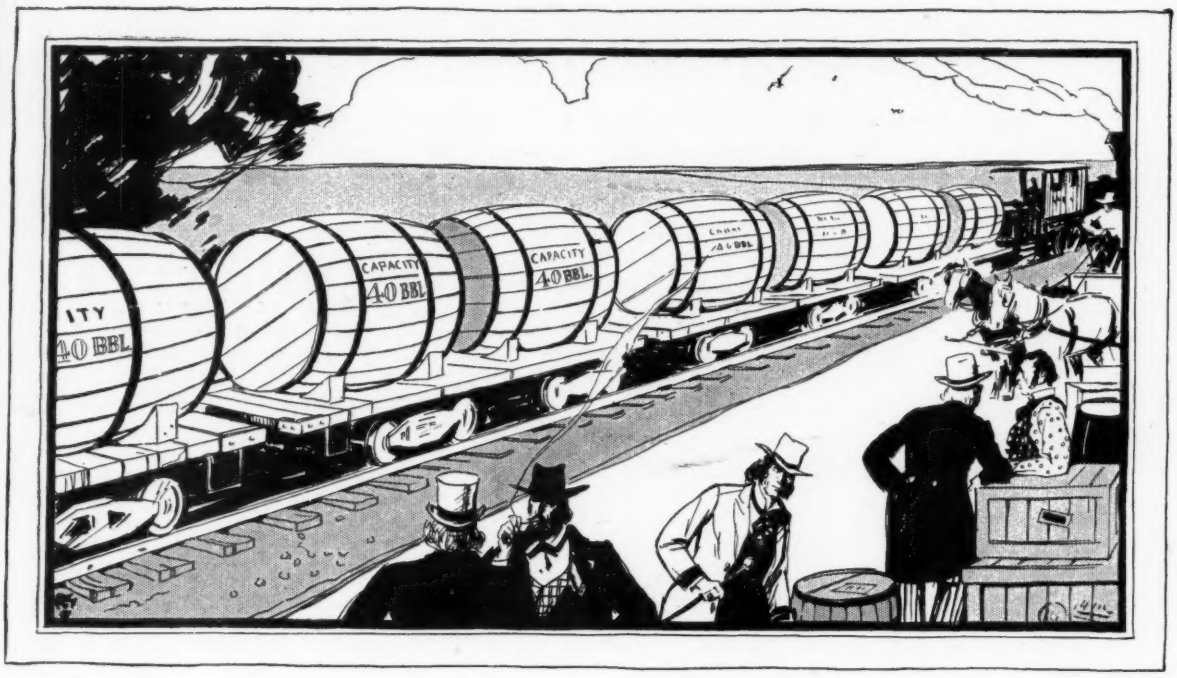
Size of Lines

It is evident that the decision as to the size of vacuum lines in the gas gathering system cannot be left to guess work, but must be carefully worked out; and in the final installation of the gathering system great care must be taken in laying and testing out for leakage this system of lines. It would be manifestly poor business to design and build an expensive plant and then reduce the size of the gathering system to the extent that drop of several inches of vacuum would be experienced from the plant to the casingheads. It is again apparent that even where a small amount of gas is handled under this high vacuum it is necessary to install large lines and meters to handle and measure the gas.

Taking up a standard text book of the industry, we find a table of multipliers for reducing gas volumes or meter readings. The following is a sample of reducing to four ounce pressure basis, gas under vacuum:

In. of Mecrucury Vacuum	4 Ounce Multiplier or Density	Example— Meter Reading Cu. Ft. Gas	Reduced to 4 Ounces Net Gas
—28	.04488	100,000	4,488
—27	.07838	100,000	7,838
—26	.11188	100,000	11,188
—25	.14535	100,000	14,535
—24	.17885	100,000	17,885
—23	.21236	100,000	21,236
—22	.24586	100,000	24,586
—21	.27936	100,000	27,936

Where orifice meters are used in the measurement of gas in the field it is necessary that the differential be the lowest possible reading. It is easy to determine the cut in vacuum you actually experience by the chart reading in the inches of water differential; there-



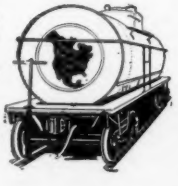
Tank Cars—Vintage of 1865

On November 1, 1865, the first tank car ever built made its appearance at Titusville, Pa. It consisted of a flat car on which were mounted two iron-bound wooden tanks, each with a capacity of about 40 barrels.

In 1868 the two wooden tanks were replaced by a single cylindrical tank, which was fitted with a dome to allow for expansion. This was the first true forerunner of the present-day tank car.

Since 1868 the history of tank cars has been one of constant development—and one of the most important of all developments has been the establishment of tank car leasing service.

The construction, maintenance and operation of modern tank cars is a business in itself, requiring much capital, a seasoned organization and highly specialized experience. Most shippers of liquids, therefore (including many of the very biggest) let a reliable car lessor act as their car supply department. Adapting their leases to seasonal requirements, they are sure of modern, well conditioned cars, and yet pay only for the facilities they use. They pay no taxes, have no depreciation or obsolescence charge-offs — and all the while have the use in their businesses of the heavy investment that car ownership entails.



NORTH AMERICAN CAR CORPORATION, Executive Offices, Chicago, Ill.

Car Shops: Chicago, Coffeyville, Tulsa, North Judson (Ind.). Oil Warehouses: Chicago, Tulsa, New Orleans

North American

CAR LEASING SERVICE

Mention Where You Saw the Advertisement

fore it is vitally important that the proper sized orifice plate be selected.

In the Burkburnett Townsite, as well as the West Field, we have a distinct handicap in the "black vacuum" that has built up in the producing sand, amounting to 21 inches. It is not hard to see what happens when a string of tubing is pulled. I think the time is at hand when the producer should adopt the use of Armour Casingheads in pulling tubing. To my mind the enormous inrush of air to the sand when the operation of pulling tubing is under way is of permanent injury to the well. With the use of Armour Casingheads, which are in successful use in the old vacuum fields of the country, practically all air infiltration into the well is eliminated while pulling a string of tubing.

I wish to state here my appreciation of the wholehearted co-operation of the producers where we are operating, which co-operation is absolutely necessary for success for both interests under the abnormal condition of production of oil, as well as natural gasoline.

Annual Address of President

*By E. L. PECK**

THE Association of Natural Gasoline Manufacturers is entering its seventh year as an organized effort to improve the general conditions of the branch of the petroleum industry it represents.

A number of important and pretentious undertakings have been launched during the past year by the association, chief of which were the research and educational campaign, the revision of the specifications, the tests to determine the best method for ascertaining the proper gravity of gas and the initiation of a movement through a committee to prevent the present wasteful and costly practice of unnecessary venting of tank cars at destination.

During the past 12 months, as shown by the most recent figures of the United States Department of Commerce, the production of motor fuel by refiners has increased approximately 17½ per cent. During the same period the production of natural gasoline has increased approximately 23 per cent, which indicates that 250,000 gallons per day has been produced above the normal requirements of refiners as measured by past experience. A portion of this overproduction has found new markets, attracted partly by the very low prevailing market prices, and partly by a better understanding on the part of consumers generally of the economic uses of natural gasoline. The major relief of the future will undoubtedly result from the broadening of markets and every member of the industry must do his share to bring about the necessary result.

Our markets are rather fluctuating as to demand and further relief would be afforded if more storage capacity, both as tankage and finance, was made available. Without doubt the natural gasoline industry is lagging considerably behind the other branches of the petroleum industry in providing adequate storage facilities for carrying over excess production due to seasonable slumps and when demand temporarily falls below normal. It is evident that the volume of such additional storage would not be excessive when the relatively small volume of production, six to eight days supply, even under our worst condition is taken into account. Inadequate storage facilities are by no means confined to the small producer or the small plant, for there has been a very evident tendency for large plant builders to hold their storage capacity proportionately below that which is usually deemed necessary in a smaller plant, and to force their production in the market almost on a daily basis.

It is doubtful if the industry ever saw a worse condition than that with which it has been confronted this year. Selling prices have been far below the cost of manufacture, while operating expenses due to increasing gas costs, increased producer service requirements, depletion of gas reserves, obsolensence of plant equipment and many other factors, continue at normal levels or increase to higher ones. We are now passing through a period which calls for a stout heart and a long purse, but do not fail to recognize that during such a period is the opportune time to apply strenuous treatment for the chronic ills of the industry as well as for the minor and temporary ailments.

All of the ills of the natural gasoline industry do not fall in the uncontrollable class. I refer to the unwholesome and unnecessary competition which has existed within our industry during the past few years, especially in the new and larger pools. The elimination of competition, at the expense of stripping a project of all chances for a legitimate profit therefrom, is certainly of no benefit to the participating companies, and does permanently injure our business by the establishment of unfair and uneconomic requirements on the remainder of the industry.

We will probably always be troubled to some extent by the new and inexperienced operator and the promoter who either does not know or is heedless of the vast difference between the securing of a block of inflated casinghead gas contracts, and the later operation of a gasoline plant, under the terms of those contracts, which results in a reasonable profit. There is, however, no possible excuse for experienced natural gasoline manufacturers to continue to build plants under conditions which are almost certain to result in leases. A smaller number of profitable projects are far more desirable, both for the individual company and the industry as a whole, than 100 per cent utilization of available casinghead gas under terms which even the novice should be able to analyze and classify as hopeless.

Over a period of years the schedule of prices paid for casinghead has remained more or less uniform but more recently there has been an upward tendency which certainly is not justified. Furthermore under other clauses of present day contracts, usually spoken of lightly as covering the usual items of service rendered by a gasoline manufacturer for the casinghead gas producer, there has been a decided tendency to increase the burden without corresponding opportunity for compensation. I refer to such obligations as: utilization of a large percentage of all of the flush gas supply regardless of the method of delivery or gas contamination due to various causes, the disregard of probable life of the supply, the failure to consider the expense of residue gas requirements for operation, development, pressure restoration and artificial flowing and vacuum application, all of which obligations are held to be prior to and regardless of the economics of the gasoline manufacturers side. The time is here when the schedule price paid for casinghead gas ceases to be the all important factor, and more attention must be given to the evaluation of the various services rendered by the manufacturer for the producer. These services are not now fully recognized by the average producer, either in the light of additional expense to the manufacturer, or as the truly sizeable saving in expense to himself which results therefrom. The burden of proof is on the manufacture if any relief is to be expected.

Recent efforts of the industry have been directed toward broadening of the markets for natural gasoline by research and publicity as well as by improvement in the quality of the product in various ways, the principal one of which is by elimination of the more volatile fractions. There is a limit, however, to improvement in this direction, so long as arbitrary test methods are used to determine the price of casinghead gas. A more equitable and satisfactory method, already in use to some extent, is to base the price of casinghead gas solely on the price and volume of the finished product, making it possible to carry the process of manufacture to any extent necessary to produce the product for which there exists the most profitable markets.

The natural gasoline industry is a basic one. While conditions are not at the best and there does not seem to be an immediate remedy at hand, I still believe in the future of our product and that a solution will be found. To that end, therefore, we must think straight and work hard and the future will show that the money, the brains and the effort that have been put into the natural gasoline industry will not have been in vain.

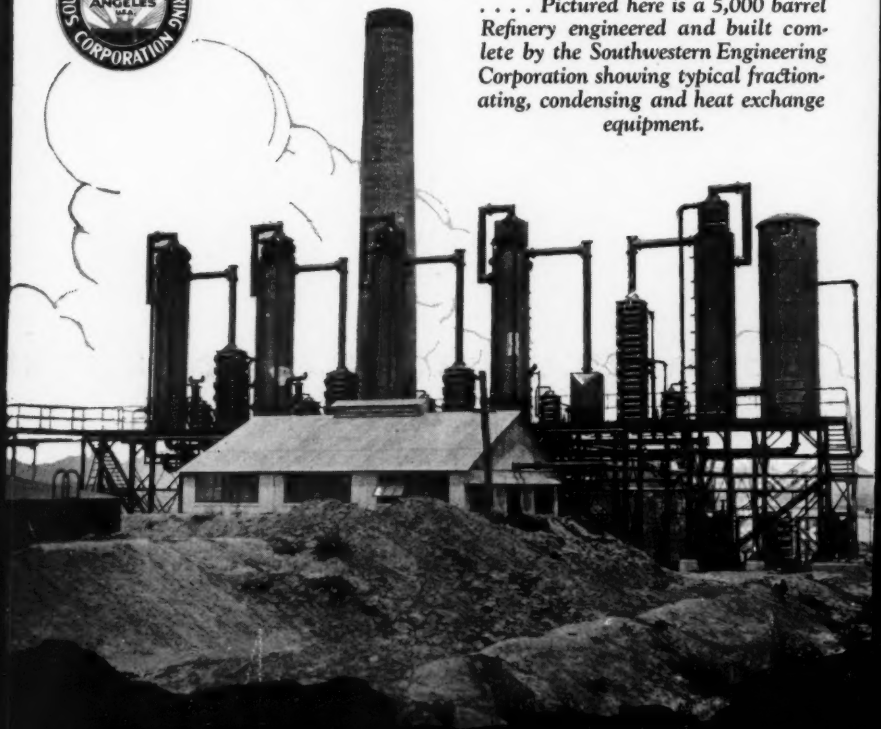
*Delivered before convention of the Association of Natural Gasoline Manufacturers.

SOUTHWESTERN
Fractionators, Condensers, Heat Exchangers.

IN refining operations where close controls are essential in the production of specification products, the quality of which must be unvarying, efficiency and flexibility are assured by the use of Southwestern equipment.

SOUTHWESTERN ENGINEERING CORPORATION LOS ANGELES U.S.A.

. . . . Pictured here is a 5,000 barrel Refinery engineered and built complete by the Southwestern Engineering Corporation showing typical fractionating, condensing and heat exchange equipment.



SOUTHWESTERN ENGINEERING CORP.
1221 HOLLINGSWORTH BLDG.
Los Angeles Calif.

Branch Offices
Joplin National Bank Bldg. Joplin, Missouri
Western Bldg. Amarillo, Texas
Main Bldg. Tulsa, Okla.
Agent
80 WEST STREET, NEW YORK, N.Y.

Small Scale Continuous Stills For Crude Oil Elevation

By R. C. BECKSTROM[1] and C. F. BARB[2]

THE Petroleum Refining Engineering Department of the Colorado School of Mines has designed a battery of continuous stills which is used for instruction purposes, and which checks the flow sheets of commercial stills when the same crude oil is used. This battery has given such excellent results that a description of it is passed on to the industry.

Figs. 1 and 2. The battery is built on a frame of two-inch angle iron, covered outside with 18-gauge sheet iron and lined inside with fire brick. The bottom of the fire box is made of quarter-inch plate covered with three inches of sand, a wall of fire brick separating the fire boxes of each still. The floor space of the battery is five feet by five feet, the height to the top of the domes is four feet, and the weight is about 3000 pounds.

Description of Stills

The stills, four in number, Fig. 3, are supported on 12-inch centers, on two-inch angle iron front and rear. Holes are cut through one flange of each angle iron to take the half-inch crude oil supply lines and when these lines are connected the stills are held rigidly in place and no other means of support is necessary. The angle irons supporting the stills are set at an angle giving a fall of one inch from one still to another, which is sufficient to permit the crude oil to flow easily from each still into the next when the battery is running continuously.

The individual stills are made up of 24-inch lengths of eight-inch casing with three-sixteenths-inch heads welded on, these stills are insulated with asbestos mixed with cement and Sil-O-Cel. Fig. 4. The dome is a two and one-half inch by nine-inch nipple welded in one-half the distance from the dome to the rear end. The lower end of the nipple is sealed and reaches to within one inch of the still bottom. The inlet and outlet openings are half-inch waste nuts welded on flush with the still bottom. The steam line inside the still is made of a 24-inch length of three-eighths-inch pipe with one end sealed and the other threaded for two inches. This pipe is drilled with three-thirty-seconds-inch holes on one-inch centers and is screwed through a one-half to three-eighths-inch bushing from the back side. This allows the pipe to be easily removed for cleaning. The pipe should be turned so that the steam jets sweep the side and bottom of the still.

The vapor lines are 24-inch lengths of half-inch pipe fitted with valves near the dome of the still. Fig. 5. The condensers and hot residium coolers are each made of 10 feet of three-eighths-inch pipe and placed in the same condenser tank for the battery. The still dome may be connected by a close nipple to two and one-half-inch reducers on which towers constructed of two-inch pipe are used with good results.

One baffle plate tower and one bubble plate type tower are used and give excellent results with the light distillates.

Crude Oil Supply

The crude oil supply comes from a 30-gallon tank set six feet above the battery, permitting the oil to flow by gravity into the stills. The crude oil line is a half-inch pipe and leads into a small heat exchange placed at the rear of the still setting. The heat exchanger is made of seven lengths of three-eighths-inch pipe, each length being four feet. Each pipe is welded into headers set in a four-foot section of four-inch pipe. The ends of the four-inch pipe are closed by four-inch to half-inch reducers. The hot residium passes through the three-eighths-inch pipe, and the crude oil passes between them and the shell. The crude oil enters still No. 1 at the rear end through a needle valve, passes through and out at the front and enters still No. 2 at the front and passes out at the rear. The same course is followed in stills Nos. 3 and 4, the hot residium passing through the heat exchanger to a cooling coil to storage.

Operation

The stills may be each charged with two and one-half gallons of crude oil from the storage tank and the fires started, or still No. 1 may be filled and brought to temperature before the feed oil is started, which will gradually fill the remaining stills. The oil level in the stills is regulated by an elbow arrangement of half-inch pipe at the front end of the battery. When in operation, these elbows are swung up to the desired level; when the system is drained they are swung down to the horizontal. The last still is regulated by the residium discharge line which is swung high enough to prevent the oil from being syphoned out of the still. The

1. Instructor in Department of Petroleum Refining, Colorado School of Mines.
2. Professor and Head of the Department of Petroleum Refining, Colorado School of Mines.

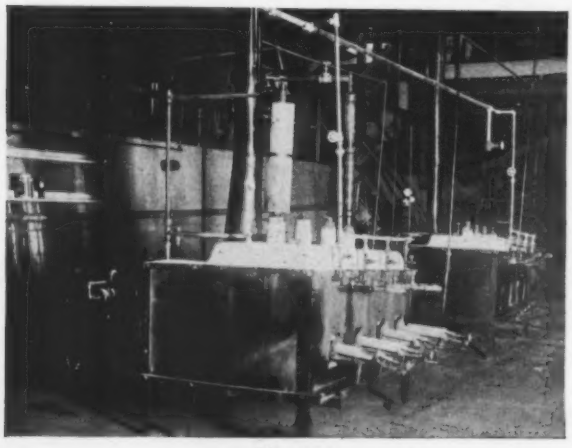


Figure 1

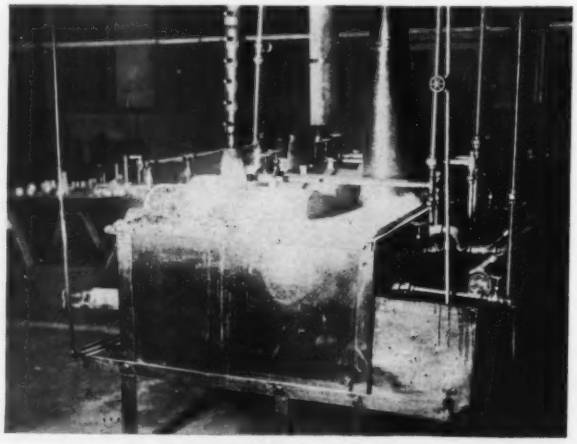
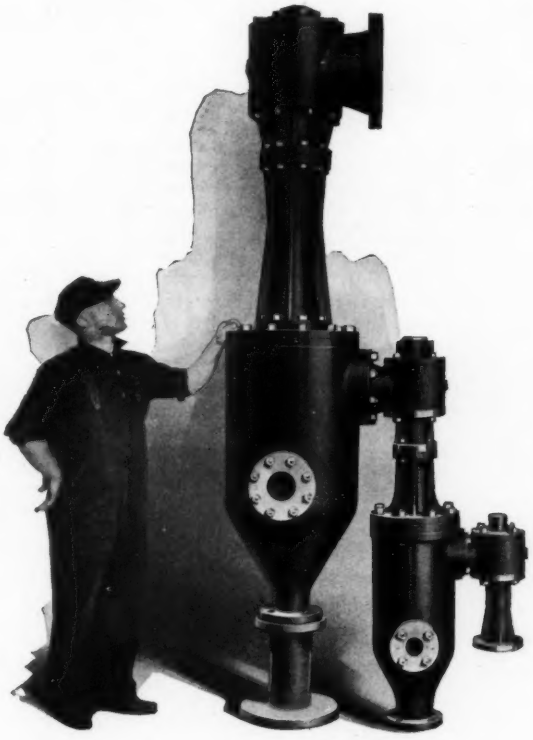


Figure 2



High Vacuum Steam Jet Ejectors and Condensers for Lubricating Oil Stills

---

Condensers and Steam Jets now on order for a vacuum of 2 m. m. (29.92″ referred to 30″ barometer.)

Ross Heater & Mfg. Co., Inc.

BUFFALO, N. Y.

Representatives in all principal cities

Mention Where You Saw the Advertisement

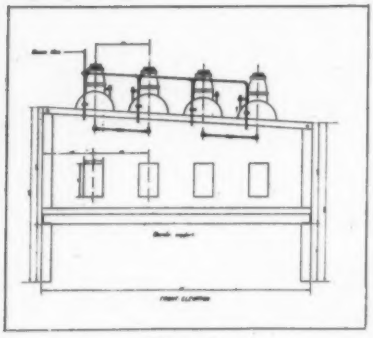


Figure 3

battery will handle from two to five gallons of crude oil per hour, the rate depending on the amount of distillate taken off. The temperatures of the stills are brought up rapidly until the temperature of still No. 1 is about 400°F; No. 2, 530°F; No. 3, 650°F, and No. 4, 750°F. When the stills have reached their respective temperatures, the crude oil feed is started, and within a short time the stills reach an equilibrium and the distillates hold constant gravities.

The stills are fired with gasoline burners and the fuel consumption is approximately one gallon per hour. Oil or gas burners can be used equally well, the gas being more easily regulated and giving greater flexibility of operation.

The battery has been used on Salt Creek, Wyo., and Osage, Okla., petroleums as well as synthetic crude oils, and gives satisfactory results. Rough fractionation cuts have been made to a predetermined gravity, and after having reached this point it operates with little attention and holds the gravities within one-half degree A. P. I. The four stills gave 58 degrees A. P. I. naphtha, 43 degrees A. P. I. kerosene, 36.5 degrees A. P. I. mineral seal and 33 degrees A. P. I. gas oil, respectively, with very little fluctuation over a period of several hours.

The overlapping of fractions taken off depends on the rate of distillation and the use of towers. The valves in the vapor lines are closed when operating with towers, the efficiencies of which may be easily determined by cutting them in the vapor stream and re-

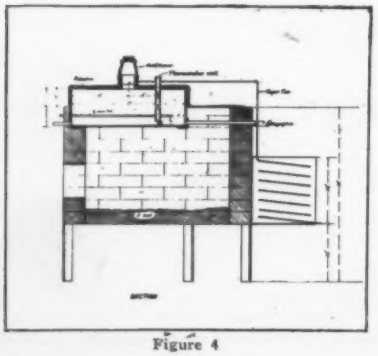


Figure 4

running the resultant distillate. On the other hand, the towers may be quickly removed and others substituted when it is desired to make comparisons under identical conditions.

Flexibility

The battery may be run continuously or may be used as four-batch stills, using the same crude oil in each, but under varying conditions, or using different crude oils under the same condition. The cost of construction is nominal and the fuel consumption low. It acts as an excellent means for the evaluation of crude oil under conditions checking commercial practice and in gaining interesting information in the use of towers. The capacity is large enough to give workable samples of the fraction for re-running and comparative study. The results are accurate and simulate commercial practice.

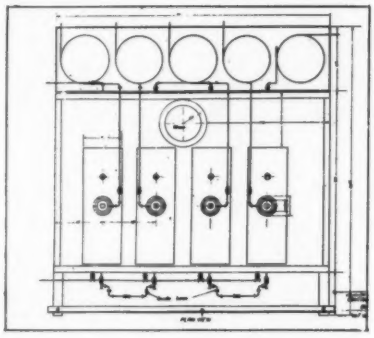


Figure 5

The United States Civil Service Commission announces an open competitive examination for senior petroleum engineer, applications for which must be on file at Washington, D. C., not later than July 5.

Expect Early Decision on Proposed New Refined Oil Rates to Middle West

Washington.—An early decision is anticipated by the Interstate Commerce Commission in the case involving railroad rates on petroleum from the entire Mid-Continent field to St. Louis, Chicago and Mississippi Valley points, on rehearing, and which was submitted to the commission on argument Friday, June 3. The carriers' tariffs are published carrying out the commission's decision of a year ago and which gives Kansas refineries a differential of two cents a hundred under Oklahoma, and preserves the Texas differential of two and a half cents over Oklahoma to the points indicated. Unless further suspended by the commission the new adjustment will become effective June 20.

Until the commission's decision Kansas and Oklahoma were on a rate parity, with Texas refineries paying two and a half cents per hundred higher. In the adjustment, however, Oklahoma was increased two cents over Kansas, a matter which the Oklahoma refineries at the rehearing showed would increase their cost of doing business from two to three million dollars annually. The Oklahoma Corporation Commission entered the case in behalf of refiners of that State, insisting that they could not endure the rate increase.

All the interests at the hearing opposed the contention of Kansas for retention of the proposed adjustment. Generally, the former favored a return to the Kansas-Oklahoma rate parity, while some favored the parity for South-Central Kansas and Northeast Oklahoma, but which would leave the Texas refineries paying a differential of four and a half cents, or about twenty-five dollars a car. H. D. Driscoll of Oklahoma City, representing the Oklahoma Refiners' Association, North Texas Petroleum Traffic Bureau and other interests suggested to the commission that if Oklahoma could not pay two cents more than Kansas, then Texas could not pay four and a half cents more than Kansas. Unless the old Kansas-Oklahoma rate parity is restored, Mr. Driscoll said all Mid-Continent points should be grouped. Testimony respecting the plight of the Texas refiners in the proposed adjustment was given at the hearing preceding the argument by J. B. Yeager of Wichita Falls.

Paul Walker, attorney for the Oklahoma Commission pointed out that under the proposed arrangement the Kansas refineries would sell their products on the basis of Tulsa, and pocket the railroad rate difference. If the arrangement was to the benefit of of the public, he said, there might be some reason for it.

In the original case Kansas asked for a four-cent differential under Oklahoma, but the commission refused to allow more than two cents. The carriers favor a return to the Kansas-Oklahoma parity leaving the Texas excess differential intact.

It was developed at the hearing that certain Oklahoma refineries situated near the Kansas border are preparing to pipe their products to a point over the Kansas line in order to obtain the lower Kansas rail rate in event the rate adjustment stands. Southwestern carriers have already suffered considerably through pipe line competition, according to the testimony and argu-

"GENTLEMEN PREFER BLONDES"

Pipeliners Prefer RED HEADS!

A new edition, Bulletin 5-E, "Tools For Pipe Line Construction," ready for distribution.

Representatives

FRICK-REID SUPPLY COMPANY
Tulsa, Okla., or any store.

ASSOCIATED SUPPLY COMPANY
Los Angeles, San Francisco, Bakersfield, Fellows

E. L. WILSON HARDWARE CO.
Beaumont, Texas.

NATIONAL TRANSIT
Pump & Machine Co.
Oil City Pa.

DISTRICT OFFICES
NEW YORK PHILADELPHIA PITTSBURGH
CLEVELAND HOUSTON TULSA DENVER

Representatives

THE GLOBE SUPPLY & MACHINERY CO.
New Orleans, La.

F. C. RICHMOND MACHINERY CO.
Salt Lake City, Utah.

MORTON McC. DUKEHART & CO.
Baltimore, Md.

REEVES & SKINNER MACHINERY CO.
St. Louis, Mo.

Hydrocarbons Occurring in Commercial Gasoline

By GEORGE REID
Staff Representative

IN the writings of several of the leading technologists and scientists of the industry during the past two years there has been presented much information relative the characteristics of the various series of hydrocarbons occurring naturally, or synthetically prepared, in present day motor fuels. Most of these data have been presented with the idea of illustrating and explaining the influence of the different series of hydrocarbons upon the anti-knock or non-detonating quality of gasoline. In the study of the technologists the non-detonating qualities of the four principal groups has been presented, this work including the paraffin, olefin, naphthene and aromatic series and the investigation has shown that the desirable quality of anti-knock increases in effectiveness with the different series, in the order named above.

The four tables accompanying this discussion have been prepared for the purpose of conveniently presenting the characteristics of the four hydrocarbon series in such a manner that their boiling points and gravities may be easily compared. These data are taken from the writings of several of the leading petroleum scientific investigators and authorities.

In the paraffin group, Table 1, which is a saturated straight chain type of hydrocarbon, the nine principal members of the series which are generally found in commercial gasolines are presented for comparison with the three other tables following. In all of the tables, where possible, the approximate A. P. I. gravity is recorded, but it is only intended for practical work. Note that the range in gravity of the paraffin series, Table 1, is from 46.8 degrees A. P. I. to 92.2 degrees A. P. I. This may throw some light on the question as to how the Mid-Continent and Eastern marketers of gasoline became accustomed to the 58/60 gravity grade of gasoline in the early days. The suggestion is "that it just naturally worked out that way."

The boiling point range of these nine members of the paraffin series is from 97 degrees F. to 453.2 degrees F. A pure paraffin base gasoline composed of a correctly proportionate mixture of these nine paraffins would result in a blend concurring nicely with present day U. S. Motor gasoline —but in point of anti-knock value, as has been conclusively proven by many investigators, this paraffin base gasoline would be atrocious, for the paraffins are notorious knockers.

In Table No. 2 is presented those members of the olefin series usually occurring in motor fuel. In examining the table it is interesting to note that as compared to Table 1 (Paraffins) that the range of gravity for members of both series or groups is very similar to some extent. The olefins ranging from about 47.5 degrees A. P. I. to 83.5 degrees A. P. I. gravity, while the paraffins range from 46.8 degrees to 92.2 degrees A. P. I. There is a like similarity in the ranges of boiling points between the two groups, which is but natural since the second series, in order to be included in the gasoline range of specifications, must conform to those specified requirements. Note that in the chemical construction that the olefin has only two hydrogen atoms less per atom of carbon than has the paraffin—for example, pentane, a paraffin has the following formula—C_5H_{12}—while the like member of the olefin series, pentene, has a formula of C_5H_{10}, or two atoms less of hydogen. Now the interesting fact relative to these two groups is that the olefins are rarely present, if ever, in straight run gasoline, but are sometimes predominantly present in the cracked or synthetic gasolines. In fact it appears that the heavier paraffins are cracked over into the lighter olefins.

In Table No. 3 is listed the naphthene group of hydrocarbons, which are of the saturated cyclic type. These hydrocarbons are found naturally in some well known crudes, such as certain petroleums from California, South Texas, Smackover, etc. Petroleum distillates subjected to cracking conditions are also the source of naphthene hydrocarbons which are found in commercial motor fuels. An inspection of the table indicates that the naphthenes seemingly have an especial forte for isomeric forms. This condition contributes much to the difficulty of isolating and analyzing the individual members of the group.

In terms of anti-knock, or non-detonation, it will be recalled that the paraffins are notorious knockers; the olefins burn more quietly and may be classed as "not so bad." Then the naphthenes, under discussion at present, can be termed as "better." The aromatics, discussed later, are "best."

A second inspection of Table 3 indicates a difference in the range of A. P. I. gravity, approximate, and in boiling points. The range in gravity of the naphthene group as given is from 46.5 to 51.5. Here it is noticeable that the increase in degree of anti-knock qualities is accompanied by a decrease in gravity of the hydrocarbon groups. The paraffins, bold knockers, range from 46.8 to 92.2 in gravity for about the same boiling range as the non-detonating naphthenes with a gravity range of 46.5 to 51.5 degrees A. P. I. The cracking plant is the source of

---

ment. In support of the commission's proposed order, however, J. F. Lawrence of Tulsa, representing the Kansas refiners, said that the commission had three times decided the issue in favor of Kansas, and that it should be allowed to stand. In opposition to this Mr. Walker for the Oklahoma Commission said that as a matter of right and law, refiners of his State are entitled to as low or lower rate than Kansas.

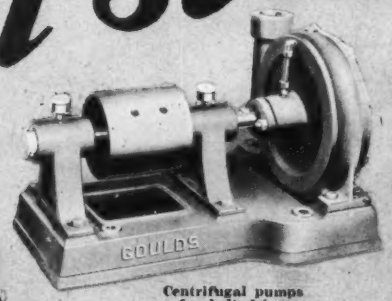
Members of the commission made inquiries indicating they had in mind the establishment of a mileage scale for the business. Representatives of the interests did not urge that it be done, in fact, it was stated that neither the shippers nor the carriers wanted it. The application of a mileage scale as result of the Consolidated Southwestern rate case, which wiped out the Texas common point adjustment, was referred to by some of the commissioners. It was not indicated, however, whether the mileage scale, if adopted, should be given application to all Mid-Continent refining points, or confined to the Kansas and Oklahoma territories with Texas carrying a differential.

A mileage rate, it is stated, would greatly change the trend of business in petroleum products from the Southwestern territory, particularly as to Kansas and Oklahoma, Shreveport and New Orleans. The amount of Texas participation in the business involved in the pending case is said to be far less than that of the other territories.

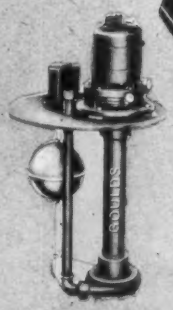
The rate adjustment upon which the pending case is based does not carry reductions, but the Oklahoma and Texas rates would be increased. As an illustration, if the rate from Kansas refineries is 32 cents per hundred, the rate from Oklahoma would be 34 cents and from Texas 36½ cents, if the proposed rates stand.

In stock—

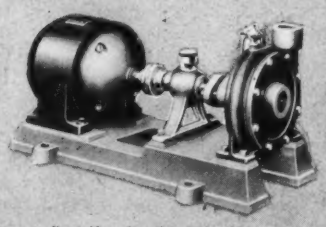
small power pumps for a multitude of purposes • • • •



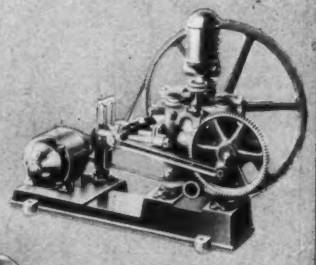
Centrifugal pumps for belt drive



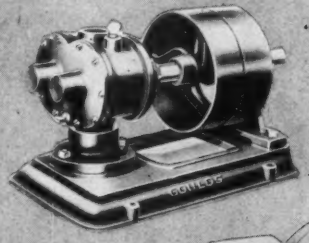
Automatic electric sump pumps



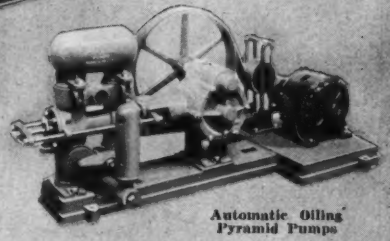
Centrifugal units with direct connected motors



"Pyramid" Motor Driven Outfits



Power Rotary Pumps



Automatic Oiling Pyramid Pumps

These small and medium capacity pumps are adaptable to a wide variety of uses in industrial plants of all kinds. Some of their many uses are:

Handling fuel oil, kerosene, and gasoline; unwatering excavations; pumping enamel, paint, varnish and other viscous liquids; loading and unloading tank cars; circulating liquids in manufacturing processes; circulating brine; booster service; water supply, etc.

Carried in stock at our factory, branch warehouses; and at mill supply houses everywhere.

GOULD PUMPS

Centrifugal, Triplex, Rotary, Vacuum, etc., for
- Air Washing and Humidifying

Building Equipment Services—
- Elevator Service
- Booster Service
- Ice Water Circulating
- Sump Pump Service
- Heating Systems

Construction Work—
- Unwatering Excavations
- General Water Supply

Fire Protection—
- General Water Supply in Hotels
- Apartment Houses
- Office Buildings
- Industrial Plants

Irrigation—

Mine and Quarry Service—
- Drainage
- Cyanide Mills
- Flotation Plants
- Refineries

Waterworks, Filtration and Sewage Plants

Petroleum Industry—
- Oil Pipe Lines
- Oil Refineries
- Gasoline Plants

Process Work—including such industries as:
- Coke and Gas
- Chemical—Cellulose
- Paper—Food—Sugar
- Textile

Refrigerating Plants—

Steam Power Plants—
- Boiler Feeding
- Economizer Service
- Condenser Service
- Fuel Oil

GOULDS PUMPS, INC. Date.....
Seneca Falls, N. Y.
Please send pump bulletins and specifications for

Kind of service.....

Name ..... Position.....

Company .....

Address .....

R&NGM-6

much naphthenic motor fuels, and cracked or synthetic gasoline is universally lower in gravity, A. P. I. scale, for the same boiling range than is the usual straight run motor fuel. Of the straight run gasolines derived by skimming plant operations it is well known that such gasoline distilled from the naphthenic crude oils of California is much lower in gravity and with the same specifications as to boiling points, than is gasoline distilled from Mid-Continent petroleums. Whereas Mid-Continent straight run gasoline of U. S. Motor fuel specifications may and usually does condense into a fraction having a gravity of 56 to 60 degrees A. P. I., the same cut from most California crude oils is collected at gravities running from around 52 to 56 degrees A. P. I.

Table No. 4 is the list of unsaturated cyclic type, or the aromatic hydrocarbons, commonly found in motor fuels. The aromatics are the best in non-detonating qualities. Benzol, or benzene as it is often termed, is an aromatic hydrocarbon fluid derived from coal tar distillation, and is the criterion or index of non-detonating measurement. Aromatic hydrocarbons are present in straight run gasoline derived from California, some Texas, Smackover, Java, Borneo and a few other petroleums. These valuable hydrocarbons are also produced from the cracking stocks fed into the cracking units. Now the unusual feature regarding this series, other than its value as an anti-knock motor fuel, is its very low A. P. I. gravity. What is considered, and has been proven to be the best motor fuel is the very lowest in gravity though very similar to the other series presented in range of boiling points of the individual members. From an "anti-knock viewpoint" it is a fact that the lower gravity motor fuels are the best, just so long as the range of boiling points are within those specified by the well known standards. Where the refiner formerly added natural gasoline to his product to give it "light" gravity, there is now a tendency to add the aromatics and naphthenic hydrocarbons to motor fuels to give it anti-knock properties and "weight," with just sufficient natural gasoline employed as is required to assure the proper volatility—or ease of starting. Natural gasoline is in itself a highly valuable motor fuel when properly blended in the right proportions with the cracked and straight run distillates.

TABLE 1

Saturated Straight Chain Type Paraffin Hydrocarbons Occurring in Motor Fuels.

Name	Gravity Appx. A. P. I.	Formula Empirical	Boiling Point—Deg. F.
n pentane	92.2	C_5H_{12}	97 Deg. F.
n hexane	78.9	C_6H_{14}	156.2 Deg. F.
n heptane	70.9	C_7H_{16}	209.2 Deg. F.
n octane	65.0	C_8H_{18}	258.0 Deg. F.
n nonane	59.2	C_9H_{20}	302 0 Deg. F.
n decane	56.7	$C_{10}H_{22}$	344.0 Deg. F.
n undecane	54.2	$C_{11}H_{24}$	383.0 Deg. F.
n duodecane	51.8	$C_{12}H_{26}$	417.2 Deg. F.
n tridecane	46.8	$C_{13}H_{28}$	453.2 Deg. F.

TABLE 2

Unsaturated Straight Chain Type. Olefine or Unsaturated Hydrocarbons Usually Appearing in Motor Fuels.

Name	Gravity Appx. A. P. I.	Formula Empirical	Boiling Point—Deg. F.
Amylene or Pentene	83.5	C_5H_{10}	104 Deg. F
Hexylene or Hexene	74.0	C_6H_{12}	154.4 Deg. F.
Heptylene or Heptene	70.0	C_7H_{14}	208.4 Deg. F.
Octylene or Ectene	63.5	C_8H_{16}	253.4 Deg. F.
Nonylene	56.0	C_9H_{18}	304.7 Deg. F.
Decene	54.5	$C_{10}H_{20}$	341.6 Deg. F.
Undecylene	...	$C_{11}H_{22}$	383.0 Deg. F.
Duodecylene	47.5	$C_{12}H_{24}$	415.0 Deg. F.
Tridecylene	...	$C_{13}H_{26}$	451.4 Deg. F.

TABLE 3

Saturated Cyclic Type.
Naphthene Hydrocarbons Found in Some Motor Fuels.

Name	Approximate A. P. I. Gravity	Boiling Point Deg. F.
Cyclohexane	48.5	176 Deg. F.
Methyl cyclohexane	50.5	213.8 Deg. F.
1, 1 Dimethyl heyane	50.5	248.0 Deg. F.
1, 2 dimethyl hexane	49.0	246.2 Deg. F.
1, 3 dimethyl hexane	51.0	248.0 Deg. F.
1, 4 dimethyl hexane	51.5	280.4 Deg. F.
1, 1, 3 trimethyl hexane	46.5	284.0 Deg. F.
1, 2, 4 trimethyl hexane	48.5	300.2 Deg. F.
1, 2, 3	51.5	296.0 Deg. F.
1, 3, 5		280.4 Deg. F.

TABLE 4

Unsaturated Cyclic Type
Aromatic Hydrocarbons Occurring in Motor Fuels

Name	Formula	Appx. A. P. I. Gravity	Deg. F. Boiling Point
Benzene	C_6H_6	28.5	176.0 Deg. F.
Toluene	C_7H_8	31.0	230.0 Deg. F.
Ethyl benzene	$C_6H_5C_2H_5$	30.0	275.0 Deg. F.
para-Xylene	.....	31.0	278.6 Deg. F.
meta-Zylene	C_8H_{10}	31.0	282.2 Deg. F.
Orth-Xylene	.....	28.5	287.6 Deg. F.
Propyl benzene	.....	31.0	316.4 Deg. F.
Mesitylene	C_9H_{12}	31.5	316-318 Deg. F.
pseudocumene	.....	29.5	327.2 Deg. F.
propyl Xylene	.....	...	402.8-410 Deg. F.

Standard Gasoline Co. Building Two Plants

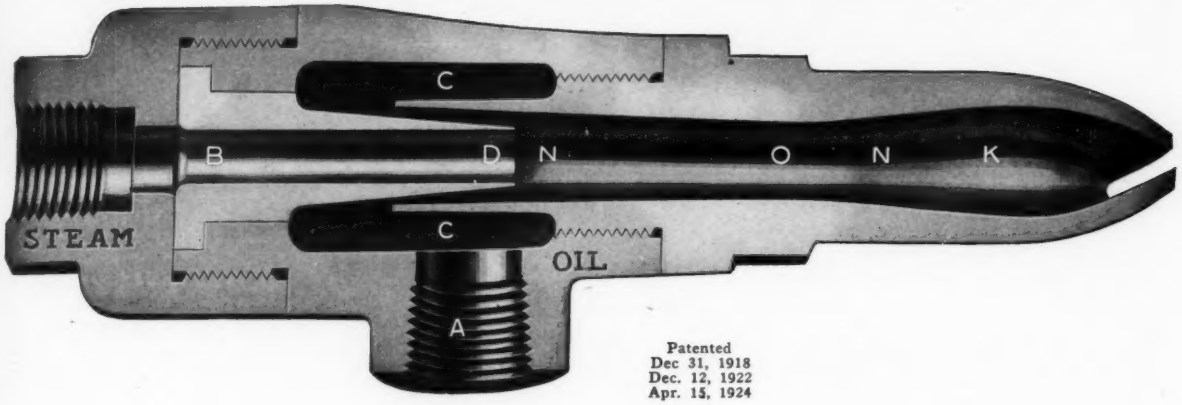
Los Angeles.—The construction department of the Standard Gasoline Company has a steady demand upon its time at present. The company is constructing a gasoline plant at Huntington Beach, and this plant, which is No. 8, consists of five C. & G. Cooper Gas Engine compressors, to operate at 30 pounds pressure, boosting the gas through the absorption plant. The absorption plant consists of four Southwestern absorbers and two distillation units.

At Ventura Avenue field construction is also progressing on the company's No. 5 Ventura. This plant will operate at 55 pounds pressure. Bessemer compressors are being installed, and a twin Bessemer will drive the line shaft. Steel buildings which will be interchangeable over the company's entire system, are also going into this plant. Both plants should be in operation around June 1.

Magnolia Enlarging Two Oklahoma Plants

Tulsa. — The Magnolia Petroleum Company at its absorption gasoline plant 20 miles north of Healdton, Oklahoma, is installing two additional units of Southwestern type, which will double the capacity of this plant and bring production up to around 10,000 gallons daily. In the Earlsboro district of the Seminole area the Magnolia is also enlarging its plant there through the installation of two more Southwestern units. This plant will have an approximate capacity of 8000 gallons of gasoline daily. At the Earlsboro plant the company has recently completed the installation of a stabilizer, which is used in blending work.

National Airoil Burners



Patented
Dec 31, 1918
Dec. 12, 1922
Apr. 15, 1924

For Power Plants and Stills and all Industrial Furnaces

NATIONAL AIROIL BURNERS
are internal atomizing burners—inside mixers—operating with either steam or compressed air; and burn as steady as a gas flame with any grade of fuel. Set your fire the way you want it, and it will burn the day through without watching or readjusting.

NATIONAL AIROIL BURNERS
will handle the heavy residuum from cracking stills without requiring continual removal for cleaning, an immense factor in economical plant operation.

NATIONAL AIROIL BURNERS
when operating under boilers will use less than one per cent of the steam generated for atomizing the oil. The old style steam atomizing burners use from three to seven per cent.

NATIONAL AIROIL BURNERS
give a soft gaseous flame that does not injure brick work or boiler tubes. Made with flat or round tips.

Write for our Bulletin No. 21

National Airoil Burner Company

Factory: S. W. Cor. 9th and Thompson Sts.
Sales Rooms: 1327 Girard Avenue
PHILADELPHIA, PA.

Oil Burners and Oil Burning Equipment

Considerations in the Design and Construction of Absorption Plant

By PAUL D. BARTON

This is the fourth of a series of articles which will compose a record of the natural gasoline industry on the Pacific Coast. Each of the series will cover a separate phase of general development.

The series have been prepared by Paul Barton, president of the California Association of Natural Gasoline Manufacturers and one of the best known men in the business on the West Coast.

II—The Cooling System

IN the series, of which the present article is the second, the writer is endeavoring to outline the important general considerations which have tended toward the development of the present-day practice in natural gasoline engineering. The purpose of these articles is to show the way in which the combination of conditions affects the design of an oil absorption plant; to give an indication as to how the engineer determines the relative importance of these conditions; and to outline the principles followed in designing for gaining the best advantage under the circumstances.

The effect of circumstances on the selection of equipment is very far reaching in any given case, and it is obviously impossible to give specific instructions. It is the intention of the writer, rather, to outline the important considerations themselves, without recommendations as to definite procedure except as regards good practice in general. It should be borne in mind that the type of plant under discussion is the ordinary low-pressure oil-absorption plant, with particular reference to California developments.

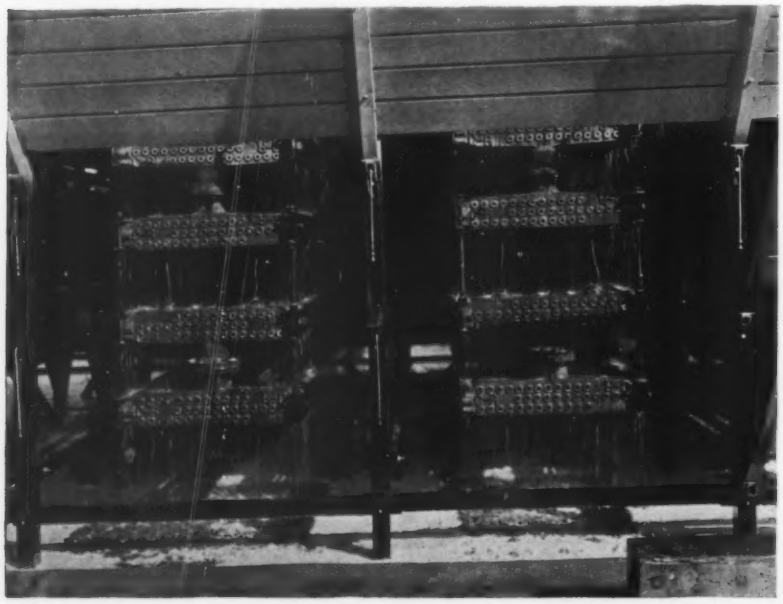
Since an oil obsorption plant is, in its bare essentials, a simple continuous circulatory system which in operation depends largely upon obtaining and maintaining a fairly definite set of temperatures at certain fixed points in the system, the efficiency of an operating plant is practically determined by the efficiency of its heating and cooling units as regards their ability to produce the desired temperatures (within the range of possibilities) and to maintain those temperatures constantly and continuously. Of the two, the cooling system is of greater interest from an engineering standpoint, due to the more or less controllable limitations which are usually working against the realization of the most desirable temperatures.

There are two general types of cooling systems in use in gasoline absorption plants,—the open and the closed. There are many modifications and possible combinations of these two types, but usually plants are designed for one or the other, as a number of construction details are affected by the choice. In addition, almost any combination of the two considerably complicates the design and operation of the plant. Another factor which has tended to keep separate and distinct the two types of cooling systems is that one, the open type, may be completely constructed of standard materials and assembled on the job by oil-field construction crews; while the other, the closed type, lends itself particularly well to manufacturing methods. The result is that closed cooling as an art, is far in advance of open cooling, although the latter is now receiving attention from the best technical minds in the industry, both natural gasoline engineers and manufacturers of plant equipment.

The main point of difference between open and closed cooling is the manner of effecting the heat transfer between the cooling water and the material to be cooled (oil, gas, gasoline vapors and water). Closed coolers are capable of strict counter-current treatment in which the velocity and turbulence of both fluids are to a large extent under the control of the designer. Open coolers are, however, distinctly limited in both of these respects.

In any comparison of these two types, it should always be born in mind that the cooling system has two general functions to perform, both of which are of almost equal importance: first, the dissipation of excess heat, and the second, the lowering of the final temperature of the circulating absorption oil to a close approach to the possible minimum (under normal weather conditions.)

The cooling system of an oil absorption plant, as a whole, includes, first, a means of cooling a fairly large quantity of water continuously. As it is desirable to cool a considerable portion of this water to a point approaching the wet bulb temperature, cooling towers are used, being undoubtedly the best and most economical means for accomplishing this result. Second, the cooling system must provide means for dissipating excess heat from the hot, lean absorption oil, from the still vapors, from the wet gas (if necessary), from the recompressor gas and vapors, from the dephlegmator (or reflux control) cooling medium, and from the jacket-cooling water (if there are gas engines or compressors in the plant). Third, the system must provide for the bringing of the partially-cooled, lean absorption oil (and usually the condensed gasoline and water) in efficient heat-exchange relation with sufficient proportions of the coldest-possible water available, so as to bring the final temperature of the oil consistently to within one or two degrees of the low-



View of 6' x 60' Wyatt's Absorber Loaded for Shipment

We have the largest and most modern plate shop in the Southwest. It is equipped with the latest type of labor saving equipment including three electric traveling cranes, spacing tables, power riveting and flanging machines, and a welding department with large capacity for both gas and electric welding.

We carry a large tonnage of flat plates in thickness from 16 gage to 1" and flat circles for making flanged heads up to 120" diameter. We also carry flanged and dished heads from 24" diam. to 120" diam. and from 5/16 to 3/4 inch in thickness.

The total floor space in the shops is 100,000 sq. ft.

These facilities represent a large investment and are available to serve you in the very satisfactory manner they have served practically every refiner and manufacturer of Natural Gasoline in this district.

We will appreciate your inquiries.

Wyatt Metal & Boiler Works

DALLAS, TEXAS

est water temperature under normal operating conditions.

It requires considerable ingenuity on the part of the designing engineer to arrange the cooling system of a plant so as to accomplish the cooling of the various products and materials to the best advantage. This is readily seen when the wide variation in the characteristics of the materials to be cooled and the difference in the desired final temperatures of these materials are considered. The following table shows the approximate quantities of heat to be removed from the different materials, and the normal cooling range for each (data from a low-pressure oil absorption plant in California, based on normal operating conditions of 60 gallons per minute oil circulation, 300 gallons per day gasoline production, compressing one million cubic feet of gas per day from 10 inch vacuum to 30 pounds pressure with gas-engine driven compressors, the gas having a gasoline content of three gallons per thousand cubic feet):

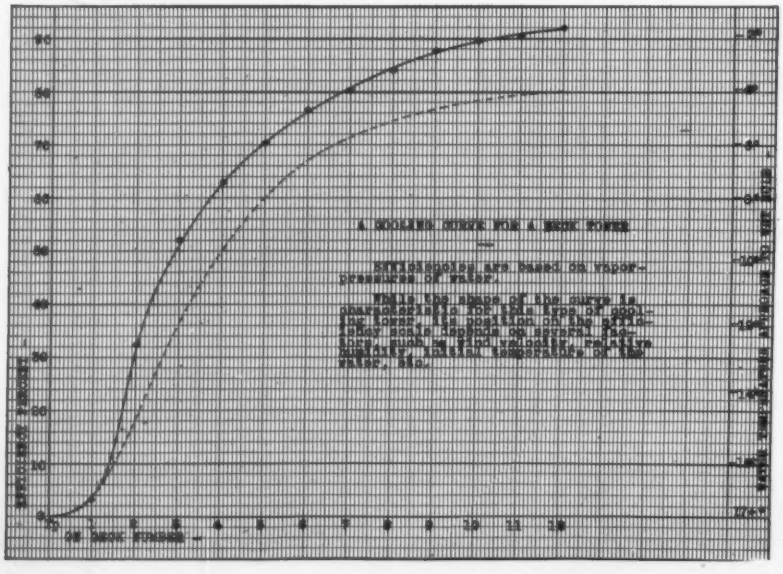
Material	Heat to be removed		Proportion of total heat	Initial temp.	Final temp.
Lean Abs. Oil	724,000	Btu/hr	27%	130°	68°
Gasoline (cond)	129,000	"	5	190	70
Water with gasoline	575,00	"	21	190	70
Wet gas	280,000	"	11	225	70
Recompressor gas and vapor	88,000	"	3	200	70
Reflux control	362,00	"	14	143	120
Jacket water	500,000	"	19	120	90
Total	2,658,000		100		

Other factors which enter into the problem of arrangement of the cooling system include relative volumes of the matrial to be cooled, pressures and pressure losses, heat transfer rates, cooling-water distribution over the cooling surface, changes of state and corresponding changes in the volume and heat transfer rates of the materials being cooled, and variation in the tendency toward scale formation on the cooling surface. Allowances must be made for the effect of scaling on cooling efficiency and there should be some provision for conveniently removing scale. In open systems, particularly, it is of extreme importance to arrange the different units and the parts of the individual units so that one part will not adversely influence the performance of another part. This last is not so simple as it might seem since for economic reasons a compact installation is desirable.

Open Systems

Lending itself as it does to the expression of the personal (and too often immature) ideas of engineer, superintendent, construction foreman, and sometimes even the welder on the job, the open cooling system has been installed in an almost endless variety of forms and combinations. Much of the work has been done by the cut-and-dry method, which while frequently yielding good results, is not conducive to the systematic development of an art. The absence of design and performance data which is definite and dependable renders this fact conspicuous. Statements as to performance are frequently colored by the enthusiasm of the designer. When actual test data is available it is hard to tell whether or not the results are the average under normal operating conditions. Some designs are particularly sensitive to weather conditions; as, for example, the congestion of a certain coil-tower within the writer's experience performs remarkably well under the conditions of low relative humidity and a good wind velocity, but the efficiency drops to a much lower figure than should be the case when atmospheric conditions are less favorable.

The open type system has a distinct advantage over the closed type insofar as dissipation of excess heat goes. This is due to the ability of the open type to take advantage of direct evaporation of water from a large part of the exposed cooling surface (usually iron pipe coils placed in atmospheric cooling towers or spray ponds and exposed both to the finely divided spray or falling water, and to the wind or air-currents). On account of its high latent heat a relatively much smaller quantity of water is required for the removal of a given amount of heat if the water is evaporated rather than merely raised in temperature a few degrees (the quantity of heat absorbed by a pound of water on evaporating is in the order of one hundred times as great as that absorbed in merely raising its temperature ten degrees F.). Not only is less water circulation required for this part of the cooling (where evaporation is taking place from the cooling surface itself) but a higher heat transfer rate is obtained under a given set of conditions than otherwise. This doubly favorable combination is the saving characteristic of the open type of cooling system and frequently reduces the total effect of the bad features of design and construction to such an extent that an otherwise worthless installation is capable of profitable operation. The efficiency of cooling by direct evaporation of water from the cooling surface requires a considerable differential between the vapor pressure of water at the temperature of the cooling surface on the one hand, and the partial pressure of water in the air around the coils, on the other hand, the latter factor largely is controlled by a free circulation of air. In the ordinary installation, and under average conditions, a 20 and 25 degree approach to the wet bulb temperature is about as good as can be expected from the evaporative effect alone.

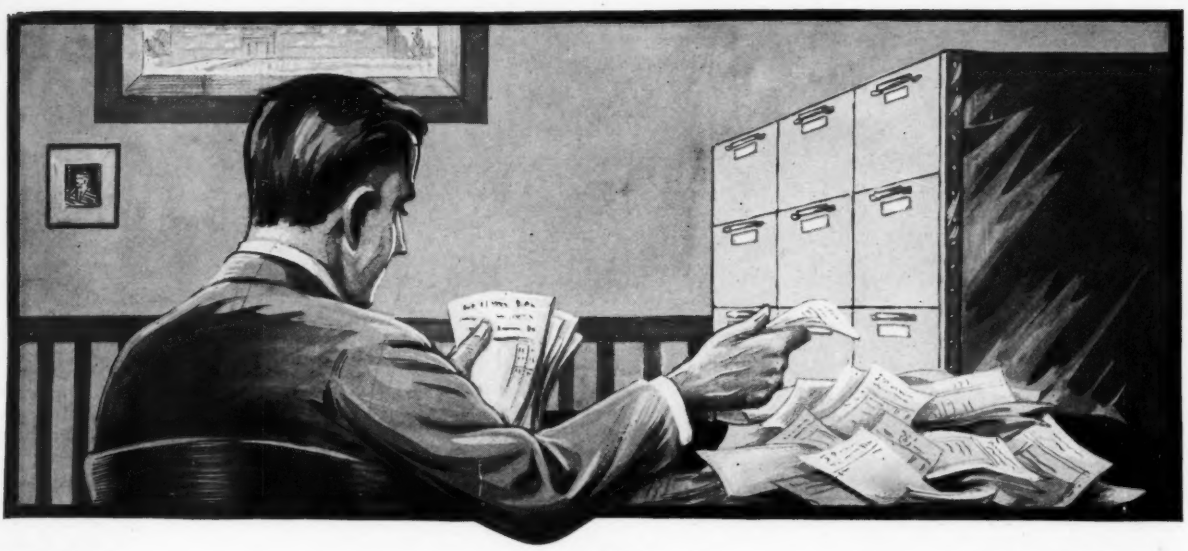


Closed Cooling has Advantage in Lower Range

The other general function of absorption plant cooling systems, the consistent realization of temperatures approaching that of the wet bulb, presents a much more difficult problem to the designer of an open type system than the dissipation of excess heat. The limited number of controllable factors, the confusing complications arising from the necessity for carrying on a difficult heat-transfer operation in the same piece of equipment simultaneously with an exacting water-cooling operation, together with the almost entire absence of dependable and definite means for rating the performance of a proposed installation, is a combination which would tax the ingenuity of an engineer of the highest ability.

In the case of the closed type, the problem resolves itself into two distinct parts: first, the separate cooling of a

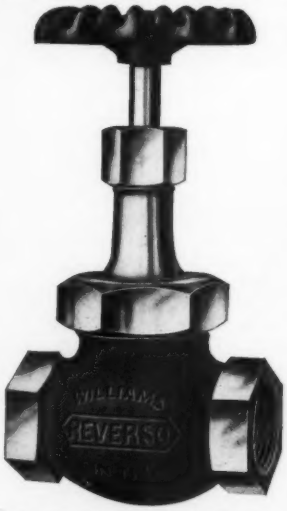
(Continued on page 112)



Throw out Repair Bills

Bills of that kind have one beneficial effect, at any rate. They make the shrewd executive think! From thinking to investigation is a short step. He wants to know the why—the reason for the bills. When found he can apply the brakes and stop them.

Ninety-nine times out of 100 the "why?" will be found in the valves. Originally these were chosen for their cheapness—the small initial outlay required for them.



No. 780 REVERSO Valve
For 200 lbs. pressure and total temperature of 550° Fahr. A long lived valve which outlasts the ordinary valve on account of its higher seat vitality. Figured on the cost per year of leak tight service, it wins its way with the closest buyers. Reversible—Regrindable—Renewable, REVERSO has every element necessary to long life and low maintenance costs. Once in the line, the Reverso is there to stay—no more replacements or excessive upkeep expense—no wastage or production losses to drain away profits.
Order a sample from your dealer.

"Penny wise and pound foolish." Those cheap valves have proved terribly expensive. Under high pressures and temperatures they have collapsed and been repeatedly replaced. They have leaked and wasted steam steadily. They have caused numerous shutdowns and loss of production—to say nothing of much greater coal consumption.

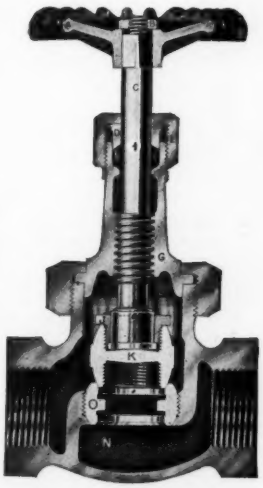
The shrewd executive replaces his cheap valves with high-grade, and naturally chooses Williams Valves. He knows the Williams Company builds valves that last. That its product represents many years of experience in valve problems. That Williams Valves are dependable, durable and economical. That material and design qualify them for superior service. That they stop repair bills.

Abroad or at home—that is the story told of Williams Valves by all progressive plants. Why they have a world-wide reputation is described in our Catalogue 10. Write for a copy.

The D. T. Williams Valve Co.

Cincinnati, Ohio

Makers of High Grade Bronze and Iron, Regrinding and Nickel Seat Stop and Check Valves, Gate, Blowoff, Hydraulic, Swing and Ball Check, Needle, Hose, Whistle Valves, Stop and Air Cocks, Unions, Fittings, Water Gauges, Gauge Cocks, Oil Gauges, Lubricators, Oil and Grease Cups, Steam Traps, Separators.



No. 780-S REVERSO Valve
Interior view of Reverso Valve. Note each detail—The wear-resisting, nickel alloy disc and seat—the reversible feature—the full free area—the union ring which secures hub to body and facilitates regrinding when necessary—the non-stripping stem which is gland packed and which is easily repacked under pressure when wide open. A non-heating wheel firmly lock-nutted to stem provides easy and comfortable operation.

Williams Valves

Mention Where You Saw the Advertisement

Desulphurizing Aceiton of Silica-Gel

By H. I. WATERMAN and M. J. VAN TUSSENBROCK
(Brenstoff Chemie, 1927)

THE authors have investigated the desulphurizing action of silica-gel on various petroleum distillates and have reported these investigations in an article, entitled Desulphurization of Petroleum Distillates by means of Silica-Gel, Brennstoff Chemie, volume 6, pages 255 ff (year 1925) and Chemisch Weekblad, volume 22, pages 378 ff (year 1925). In these experiments the authors dissolved several sulphur compounds in kerosene and then tested out the desulphurizing action of silica-gel on the mixtures thus obtained. In carrying out systematic investigations on the desulphurizing action of silica-gel, it was found necessary to make up artificial mixtures of the various distillates and definite sulphur compounds. It was not found advisable to work with sulphur-containing crude oil distillates in which the nature of the sulhpur compound with the hydrocarbons in the oils was not accurately known. Furthermore, it is necessary to select for this purpose sulphur compounds of a nature similar to those that are met with in the practical desulphurization of petroleum distillates.

The compound, ethyl sulphide, which was used in these experiments, was in the form of a water-white liquid with a boiling point of 92 to 93 degrees C. This product was dissolved in a low boiling gasoline, boiling point 40 to 60 degrees C. The gasoline, before it was admixed with the sulphur compound, was practically free from sulphur. The sulphur content was accordingly 0.006 to 0.007 per cent. It was calculated that the ethyl sulphide solution, which was prepared for this purpose, must contain one per cent of sulphur. In each experiment 8.44 grams of ethyl sulphide were dissolved in 291.6 grams of gasoline. The analysis of the mixture revealed a sulphur content of 0.97 per cent. The common combustion method was employed for this purpose.

The silica-gel was prepared from technical water glass. Three hundred grams of washed and air-dried product were then activated by heating for one and one-half hours at a temperature of 225 to 250 degrees C while dry air was led over the mass. This resulted in the production of 221.8 grams of the activated gel. Thus in activation almost 80 grams of water were driven out of the silica. The activated gel was stored in a dessicator and after a period of five days its weight had increased to 222.2 grams.

The gel was then separated into various fractions by means of screens. Three screens were used for this purpose, namely, Nos. 10, 20 and 40. No. 10 had 110 meshes per square centimeter, No. 20, 360, and No. 40, 1050 meshes. The inside width of the meshes was from 0.6 to 0.7 millimeters in the case of screen No. 10, 0.29 to 0.37 millimeter in the case of screen No. 20 and 0.17 to 0.20 millimeter in the case of screen No. 40. The thickness of the wire in screen No. 10 was 0.15 to 0.27 millimeter, 0.13 to 0.26 in the case of screen No. 20 and 0.10 to 0.15 millimeter for screen No. 40.

The sieving analysis of the silica-gel gave the following results:

	Grams
Residue left on screen No. 10.....	1.2
Residue left on screen No. 20, but passing through No. 10	60.35
Residue left on screen No. 40, but passing through No. 20	55.45
Amount passing through screen No. 40..	109.70
Total	226.7

It is thus evident that the total weight of the silica-gel has increased approximately four and one-half grams during screening by absorption of water. The loss that is incurred during the sieving process, due to dusting, is not taken into consideration, as it is too small to bother with. Only three of the four fractions of silica-gel were used in the experiments. The average percentages of moisture for the three silica-gel fractions, determined by heating to incandescence, were 5.7 per cent, 6.5 per cent and 6.0 per cent.

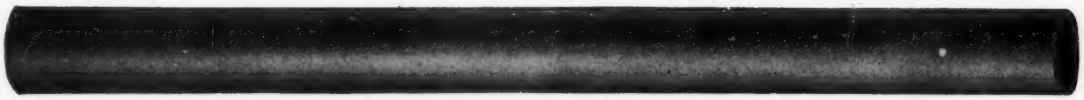
Thirty grams of the mixture of ethyl sulphide and gasoline were weighed out for each experiment in a flask and two grams of silica-gel were quickly added to it. Then the mixture was agitated for a period of three hours at the room temperature in a common type of laboratory shaking machine. The experiments were not conducted under constant temperature conditions. Nevertheless, the results can be properly compared with each other, for all the experimental conditions were maintained constant in all the experiments. The determination of the sulphur content of the treated gasolines was carried out in accordance with the common combustion method. The small type of lamp was used in this analysis, and the combustion gases, which were thus obtained, were led through a solution of hydrogen peroxide of three per cent concentration. The sulphuric acid, which then was formed due to the oxidation of the sulphur by the hydrogen peroxide, was thereafter determined by the volumetric methods, that is titration with standard alkali solution using methyl red as an indicator. It is possible to cause the flame to burn without the formation of soot, and this therefore means under the condition of complete combustion. This condition is brought about by the proper regulation of the height of the flame and of the amount of combustion air that is fed to it.

The results that were obtained in this experiment are given in the following tabulation.

Quantity of silica gel used	Size of Particles of silica gel	Sulphur content before treatment	Sulphur content After treatment	Quantity of sulphur absorbed in % on original oil
I 2 gms.	Passes through No. 10 but not No. 20.....	0.97	0.93	0.04
II 2 gms.	Passes through No. 20 but not No. 40.....	0.97	0.89	0.08
III 2 gms.	Passes through No. 40.....	0.97	0.88	0.09

The results contained in the above tabulation show clearly that silica-gel of the coarsest character, that is silica-gel No. 1, possesses the slightest desulphurizing action on the sulphur compound in the gasoline, while the two finer grades of silica-gel are active and their effect in removing the sulphur content of the gasoline can be judged to be about equal. It is therefore possible to draw the practical conclusions from these experiments that it does not serve any useful purpose to grind the silica-gel any finer than what is represented in the two finer grades of silica-gel mentioned above. It must also be remembered that there is connection with this practice the additional advantage of reduction of the loss due to dusting while screening to a very minimum.

In order to determine the moisture content in the silica-gels, the two finer ground products, that is silica-gels Nos. 2 and 3 were employed. Two grams each of these two silica-gels were weighed out and then spread out in the air. The purpose of this treatment was to allow these samples to absorb moisture from the atmosphere, before they were admixed with 30 grams of the solution of gasoline, that is gasoline containing the dissolved ethyl sulphide. The total water content can be calculated from the in-



Pittsburgh Seamless Tubes Withstand Severe Service

The greater strength and durability of Pittsburgh Seamless Steel Tubes is especially advantageous in the oil industry because of the severe conditions encountered. The recognition of "Pittsburgh Seamless" quality is reflected in increasing our brand in both the production and refining branches of the industry.

Pittsburgh Seamless Boiler Tubes and Still Tubes

are proving eminently satisfactory to refiners. They are made by piercing solid billets of basic open hearth steel, and a high standard of quality and inspection is maintained. We also make seamless steel casing up to 12½ inches in diameter, and drill pipe of extraordinary strength. We shall appreciate your inquiries.

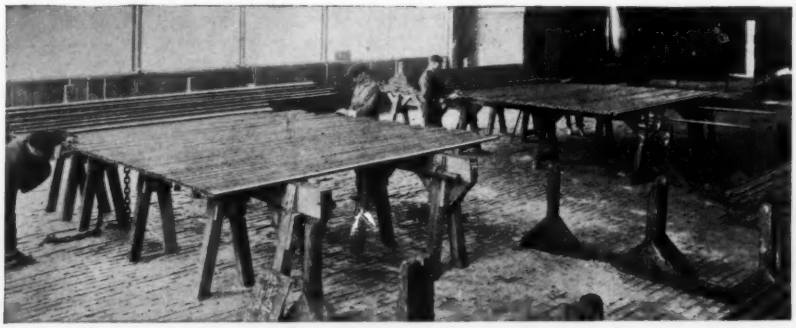
Pittsburgh Steel Products Co.

Pittsburgh, Pa.

New York — Second Nat'l Bank Bldg., Houston, Texas

Detroit

Chicago — Atlas Life Bldg., Tulsa, Okla.



Inspecting Tubes

crease in weight and the original percentage of moisture in the silica-gel. The experiments were also repeated in the following manner: Two grams of silica-gel were t aken each time and admixed with 30 grams of the solution of ethyl sulphide in gasoline, and the mixture was then shaken for a period of three hours, and the sulphur content of the mixture was then determined in accordance with the method which has been described above.

The results that were obtained from this series of experiments are contained in the following tabulation:

Quantity of silica gel used.		Size of particles	Original percentage of moisture	Moisture after-exposure to air in %	Sulphur content before treatment	Sulphur content after with silica gel	Per cent of sulphur absorbed on original
2 gms.	II	Passes through No. 20 and not 40	6.5	10.6	0.77	0.95	0.02
2 gms.	II	Passes through No. 20 and not 40	6.5	10.7	0.97	0.97	0.00
2 gms.	III	Passes through 40	6.5	9.4	0.97	0.94	0.03
2 gms.	III	Passes through 40	6.5	10.0	0.97	0.95	0.02

It is seen from the results that are given in the above tabulation that as the moisture content of the silica-gel increases, the activity of the product in desulphurizing petroleum distillates, such as gasoline, is considerably reduced. It is also seen at the same time from the aforementioned figures that there is but very little difference between the effectiveness of the two different finenesses of silica-gel, as far as their sulphur-removing properties are concerned. It is therefore of no importance or value to grind the silica-gel to a condition that is finer than that represented by silica-gel No II. It must also be understood that the silica-gel must not be too coarse, for the silica-gel in the coarsest condition, as represented by No. I and as seen above from the first series of experiments, is least active of all, although it possesses the lowest proportion of moisture, which means in the best condition from this standpoint.

The White Star Refining Company of Detroit recently placed an order with the Chicago Bridge & Iron Works of Chicago for the fabrication and erection of four gasoline storage tanks 20 feet in diameter and 20 feet high. They are being erected at plant No. 5, located at Charles and Mt. Elliot Streets, Detroit.

Pure Oil Duck Farm

Ardmore, Okla.—The boys at the Pure Oil Company's refinery here, besides operating the skimming and cracking units, are breeders of wild ducks. The regular crew of "wild duck punchers" officiate to make the birds feel safely at home. Recently it became necessary to move some 600 wild ducks from one pond to another about a mile away. The ducks were promptly herded over, each duck being "bull dogged" and each duck arrived at the new pond branded with the Pure Oil brand, and no duck got away, nor was any duck injured by the "duck punchers." The birds are now enjoying their new feeding grounds—and the duck department points with pride to its "duck farm."

Build 1000 Barrel Plant At Wainwright, Alta

Wainwright, Alta.—According to a recent announcement, the Price Development & Refining Company will start upon the construction of a new refining installation here immediately. The first unit will have a capacity of 1000 barrels daily. Shipments of tractor oil and lubricating oils are expected to begin September 1. The company plans to construct a second refining plant in the near future, either at Saskatoon, Sask., or at Vancouver, B. C. R. A. Price is head of the company.

Feed him
FRESH-COOL-AIR
—and he'll work with greater ease, comfort and safety.

The M-S-A Standard
HOSE MASK

Supplies a continuous stream of fresh air to workers in Tank Cars, Oil Tanks, or in any confined gaseous space.

Send for Bulletin No. 99F for complete information on this and other types of Hose Masks

Mine Safety Appliances Co.
Braddock Ave & Thomas Blvd. Pittsburgh, Pa.

Standard for the American Gas Association

Mention Where You Saw the Advertisement

Oceco Tank Equipment *is used all over the World*

Wherever oil is stored, there, too, is Oceco Equipment.

Its use is not limited to one state or one nation or even one hemisphere but is *world-wide*.

There is no substitute for quality and only the *unequalled character* and *performance* of Oceco Equipment could have resulted in its acknowledged position of leadership today.

Insist upon this *time-tested* equipment for your tanks, too. Let us quote you.

THE OIL CONSERVATION ENGINEERING COMPANY

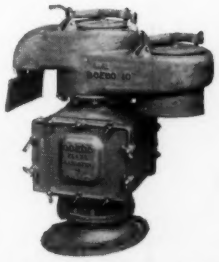
Headquarters for Tank Equipment

877 Addison Road **Cleveland, Ohio**

Engineering and Sales Service at:

25 Broadway, New York — O-S Building, Casper, Wyo.
417½ So. Boulder St., Tulsa, Okla. — Box 552, Beaumont, Texas
Neilan, Schumacher & Co., Los Angeles, Cal.

Cable Sheave Bracket



10" Type B Vent Unit

OIL TANK OCECO EQUIPMENT
SAVES EVAPORATION AND PREVENTS FIRE

New Method For Flash Test

By V. T. DOWNEY
National Refining Company

THE definition for flash point, as given by Redwood, is as follows: "The flashing point or flash point of an oil is the empirical temperature at which it gives off sufficient vapor to ignite momentarily on the introduction of a flame or spark, when the oil is heated at a given rate, in an apparatus of given construction and dimensions, aid a definite igniting agent is applied in a given manner."

This definition is almost invariably misquoted by the nontechnical man as follows: "The flash point of an oil is the temeprature at which it begins to give off inflammable vapors."

This misquoted definition of flash point has been misused in sales propaganda more than any other physical test of lubricating oils. It has worked to the advantage of the refiner of one type of crude and the distadvantage of another. The misconception has grown until an element of danger, inferiority and instability is now associated with an oil of relatively low flash point.

The use of flash point as a safety standard in connection with the use of kerosene and naphtha is justifiable. Any oil starts to give off inflammable vapors at a much lower temperature than its flash point. It is the character of the vapors formed and their concentration which determines the point at which they will flash.

*Read before spring meeting of the National Petroleum Association, Cambridge Springs, Pa., April 28 and 29, 1927.

Care Essential

As far as I have been able to determine, we have no authentic information on the type of hydrocarbon formed by the decomposition occurring during the making of a flash test. We are told that the amount of decomposition is proportional to the amount of heat applied and to the time of exposure to such heat. By varying the rate of heating we can vary the amount and type of hydrocarbon vapors given off. We are, therefore, justified in demanding that the greatest of care be exercised to heat all samples at a uniform rate so as to get a uniform type of vapor as well as to control the concentration.

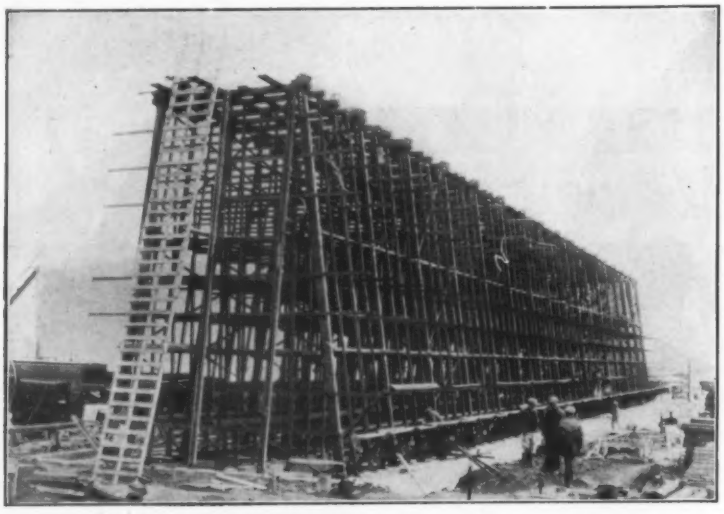
With the Cleveland cup, where no provision is made for stirring the oil, it is impossible to prevent the oil from becoming considerably higher in temperature next the sides of the cup than in the center. This means that the vapor concentration is greater at the point where the igniting agent is applied over the center of the cup.

With testers of the Pansky-Martens type, where a stirrer is employed, an even distribution of heat is obtained and the error due to air currents is greatly reduced. Our Standards department has given a great deal of thought and time to the subject of a suitable thermometer for the flash test. In our group meetings we have found only one criticism. It is reported that in some thermometers a distinct lag is noticeable. The error traceable to this lag is reported to be as high as 10 to 15 degrees Fahrenheit. It is agreed that error due to faulty thermometers can be eliminated by checking against a standard instrument at regular intervals.

Burner Selection

We have decided on a cup of definite size and shape. By doing this, we insure having the same amount of oil in each test, we have the same amount of heating surface and we have the same evaporation surface exposed in each test.

We have specified no distinct type of



Building the largest single Atmospheric cooling tower in the United States. In operation at a large refining plant in Oklahoma.

Erecting a Modern Cooling Tower
—a Job for Specialists Exclusively

A modern cooling tower for refinery use is something more than a frame with decks and louvres. Its design and performance are based on years of experience and observation in this field. Building a modern cooling tower is a job for specialists exclusively.

Our company is composed of engineers whose long experience with cooling water problems entitles them to your confidence. We have designed and built cooling towers and spray nozzle cooling systems for firms like Marland Refining Company, Humble Oil and Refining Company, Union Oil Company, Roxana Petroleum Company, and others equally well known.

Write for Literature

THE COOLING TOWER COMPANY, INC.
15 John Street New York

Houston, Texas
The J. A. Rossiter Co.,
410 Union Nat'l Bank Bldg.

Tulsa, Okla.
J. F. Pritchard & Co.,
910 Mid-Continent Bldg.

Los Angeles, Calif.
N. O. Fleming Co.,
5815 Maywood Ave.,
Huntingdon Park

Representatives in other Principal Cities

One *of* Three

When you read *The* REFINER AND NATURAL GASOLINE MANUFACTURER, you are looking at only one of three oil papers published by the Gulf Publishing Company.

And if all three papers were bound under one cover into one magazine you would have a paper about twice as big as *The* REFINER AND NATURAL GASOLINE MANUFACTURER is, dealing in an intimate way with the problems of *all three* of the great branches of the oil business.

And the combined circulation of these three specialized oil journals would be around 25,000!

The reason for our covering the oil business with three papers instead of one is obvious. The oil producer isn't interested in how the oil marketer increases the gallonage of gasoline at a particular station, nor is he interested in the technical problems of a refinery executive or superintendent. On the other hand, the refinery superintendent isn't interested in how to drill a well, and so on down the line.

This is a day of specialization. This is a day when the man doing a job well must study, primarily, his own work and needs. *The* REFINER AND NATURAL GASOLINE MANUFACTURER gives you plant news, comment, engineering articles, methods articles, and data on new equipment without burdening you with matter in which you have no particular interest.

—that's why it is growing!

burner for the flash test, yet we insist on a uniform rate of heating. This would appear to leave the method open to considerable criticism. Criticism would be justified here if the same gas supply were available at each laboratory. The gas supply varies so greatly that it is left to each individual operator to select the type of burner which will give the best heat and which is the easiest regulated. In taking flash tests on the Pennsylvania 650 and 700 fire test stocks, it is practically impossible to control the rate of heating so as to conform to specifications.

When we attempt to force a burner to secure the necessary heat in a case like this, we introduce another error. We are creating air currents around the test apparatus which disturb the velocity of the vapors leaving the surface of the oil. The remedy for this would be to connect the burner shield to a ventilator.

In one of our group meetings it was stated that the chief chemist of a large refining company, a member of the National Petroleum Association, insists that the A. S. T. M. flash point method does not call for the passing of the test flame from rim to rim across the diameter of the cup. He insists on bringing the test flame down to the plane of the top of the cup a half-inch in from the rim, passing it across to within a half-inch of the other rim and raising it vertically from the cup. The method as published does not state that test flame cut both rims of the cup in its sweep.

His reason for not touching the rim of the cup is as follows: The oils have a tendency to creep up the sides of the cup, some oils more than others. This leaves a very thin film of oil exposed to the hot metal surface. The heat transfer, of course, is more rapid than through the main body of the oil and overheating results. When the test flame is brought down into the plane of the top of the cup the tip of the flame a great many times touches this thin film of overheated oil and flash results. This flash takes place in a downward direction. When the test flame is applied in this manner and this momentary ignition taken as the flash point, the result is 10 to 15 degrees below the results obtained when the flame is applied a half-inch in from the rim.

True Flash

Our standard method of test states that the appearance of a flash at any point on the surface of the cup shall be taken as the flash point. This flash may occur at the edge of the cup or at the center.

It is my opinion that unless the flash covers the entire surface of the cup the true flash point has not been reached. If the flash does not cover the entire surface of the cup it means that the vapors are not being equally driven off over the cup. If they are not driven off equally over the cup there is overheating taking place at some point. This is contrary to the basic idea, which brought about the development of this test.

In view of the above mentioned criticisms, the writer thinks that the following definition, a modification of Redwood's defines more exactly the actual flash point of an oil.

"The flash point of an oil is the empirical temperature at which the vapor concentration reaches the point where it will ignite momentarily on the introduction of a flame or spark, when the oil is heated at a given rate, in an apparatus of given construction and dimensions so designed that localized overheating does not take place, and a definite igniting agent is applied in a given manner."

New Absorption Plant

The new absorption gasoline plant of the Petroleum Securities Corporation in the Ventura Avenue field, California, is now in operation, treating gas from the company's well, Orton No. 1, which yields about three-quarters of a gallon per thousand cubic feet.

The R. & G. Oil Company of Los Angeles, has recently completed the installation of a Southwestern Engineering Corporation portable absorption gasoline plant in the Cat Canyon field near Santa Maria, California. The production of the plant is about 2500 barrels daily.

THE WATEROUS ROTARY PUMP

Waterous Pumps Are High in Efficiency

High efficiency is the result of patented design, refined manufacturing methods and rugged construction.

Each Waterous pump exceeds its guaranteed efficiency before leaving our hands.

There are many other high-grade Waterous features that we would be glad to explain. Catalogue upon request.

Pressures to 300 lbs.

Capacities to 2000 G. P. M.

WATEROUS COMPANY

SAINT PAUL, MINNESOTA

New York City Office: 342 Madison Ave.

Also Manufacturers of the Waterous Fire Hydrant

REFINERS - - -

Do You Want these economies! - - and benefits

#1- MILD EVEN TEMPERATURES
#2- LARGE VOLUME COMBUSTION GAS
#3- REDUCED MAINTENANCE COST
#4- INCREASED THRUPUT AND YIELD
#5- A SUBSTANTIAL SAVING IN FUEL

- - then — write us now

B. P. LIENTZ & CO.

KANSAS CITY, MO.

LOS ANGELES FT. WORTH NEW YORK

NO OBLIGATION Lientz Combustion Engineers will be glad to advise with and point out to you the economies, the conveniences and the advantages of the Lientz Recirculating System. This will be done without obligation. Write us today.

The LIENTZ RECIRCULATING SYSTEM

Humble Enlarging West Texas Refinery

Houston.—Humble Oil & Refining Company has started a program of enlargement for its McCamey skimming plant, which, according to plans, will raise the daily crude run capacity from around 9000 barrels to approximately 11,000 barrels. One still is being added to the plant, making a total of five.

The McCamey plant was formerly located at Hearne, on the Humble's main pipe line from North Texas to the Gulf Coast, and was moved to McCamey in the fall of 1926 with increased West Texas production, and has been used by the company to supply a fuel oil contract with the Southern Pacific.

The McCamey skimming plant is topping rane, Upton and Pecos County crude, getting an average of 23 per cent gasoline, 70 per cent fuel oil, five per cent distillate with roughly two per cent waste residue.

Acid Recovery Bulletin

Copy of a catalog, descriptive of the Simonson-Manitus Vacuum Process for the recovery and concentration of sulphur acid is obtainable from the United Lead Company, 111 Broadway, New York.

Aside from the description of the process, the book carries valuable information on sulphuric acid, as used in petroleum refining.

McKim Metallic Asbestos Gaskets

COPPER

ALUMINUM

MONEL

ARMCO

Plain or Corrugated

Catalog No. 17 on Request

McCord Radiator & Mfg. Co.

Manufacturers of McCord Force Feed Lubricators

DETROIT, MICH.

California—Chandler & Warden, 121 West Pico St., Los Angeles

Louisiana Pulp Mill Will Use Gas For Fuel

Shreveport, La.—Another pipe line outlet for the surplus gas production in the Monroe field is to be provided by Hodges & Casey, who have headquarters at Ruston, Louisiana, and the gas will be used to supply the fuel requirements of a pulp mill. New England interests have acquired a large amount of timber south of Ruston, and will erect a pulp mill. The line to be built by Hodges & Casey will require about 45 miles of pipe, and it is planned to use seven-inch welded pipe obtained from Germany. Well pressure will be used to boost the gas through the line, and daily deliveries are expected to run in excess of 5,000,000 cubic feet.

Texas Company Building Two Gasoline Plants

Shreveport, La.—The Texas Company is planning to start construction work shortly on two natural gasoline plants in Louisiana fields, including a high pressure absorption plant to be built in the Cotton Valley field. The gas to be handled in the Cotton Valley plant offers a yield of about one-half gallon of gasoline daily, and the plant is to be equipped to handle in excess of ten million cubic feet daily. The second plant is to be built at Mansfield, where a small volume of rich gas is available on the company's leases. The latter plant will be equipped to handle about one million cubic feet of gas daily, with a recovery of four gallons per 1000 cubic feet.

Celite Products Bulletin

The latest bulletin published by Celite Products Company, 1320 S. Hope Street, Los Angeles, gives up-to-date information on the use of Celite in concrete, including a discussion of the use of this material where the water-cement ratio is specified.

The bulletin also includes considerable data of general interest on the subject of concrete construction with particular reference to the effect of workability on the uniformity, strength, water-tightness, permanence and appearance of the concrete.

Copies may be secured by asking for Bulletin 325-B.

Paul D. Barton, consulting engineer of Los Angeles, and president of the California Natural Gasoline Association, drove through from the West Coast to attend the convention of the Association of Natural Gasoline Manufacturers which closed here May 26. Mr. Barton spent several days in Tulsa and surrounding territory visiting many of the refineries and natural gasoline plants. Previous to going to California Mr. Barton was connected with companies operating gasoline plants in the Mid-Continent territory.

Correct design insures satisfactory service

HEAT EXCHANGERS

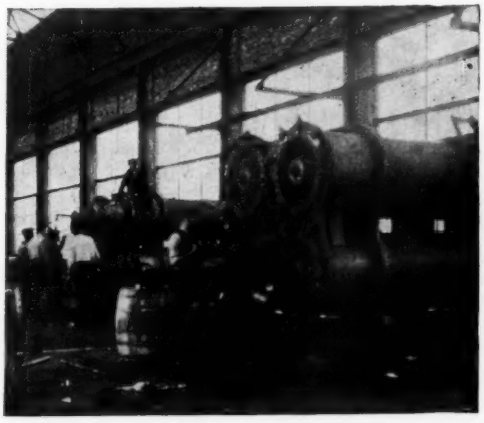
are designed in every case to meet specified operating conditions

Single-and Multiple Barrel Types
Bulletin 12-H

We are equipped to build units of large capacities

Send for Booklet showing, in condensed form, all of the S. & K. Refinery Equipment

SCHUTTE & KOERTING CO.
1253 N. 12th Street, Philadelphia, Pa.



Four-Barrel Heat Exchangers

RUBSHELL PAINTS

Recent experiments show the following:

Where strong acid conditions prevail use one coat Rubshell Priming and two coats Rubshell No. 2.

Where Hydrogen Sulphide is present and on under side of roofs of crude oil tanks use Rubshell Priming with Rubshell No. 4.

In Gasoline tanks also in condenser boxes containing hot salt water use Rubshell Priming with Rubshell No. 1.

Sole Manufacturers

International Compositions Co., Inc.

25 Broadway, New York

Agent for Texas: J. A. ROSSITER COMPANY
410 Union National Bank Bldg., Houston, Texas

Reading Gage Booklet

The Morgan Gage Company, Rockaway, N. J., has recently published a booklet which describes Morgan direct reading gages, Model FO-2. This gage is recommended for determining the amount of oil in indoor fuel tanks.

Copies of the booklet can be obtained by request to the company.

General Laying Gasoline Line From Brea Field

Los Angeles, Cal.—A three-inch gasoline pipe line being laid by the General Petroleum Corporation, from its gasoline plant near Brea, Orange County, is almost completed. The General will transport all of its gasoline production in the fields around Brea to its Los Angeles refinery by means of this line. The new gasoline pipe line is 33 miles in length. This is in line with the usual California practice of gasoline transportation and serves to virtually eliminate heavy evaporation losses.

Frank J. Donnelly has joined the New York office of the Botfield Refractories Company of Philadelphia. He will cover the New Jersey territory under the direction of Charles C. Phillips, New York district manager of the company.

IN a trembling voice he confessed to the "big boss" that he had made a costly blunder. In a moment of forgetfulness he had allowed the temperature to get out of bounds in an important heat-treat process.

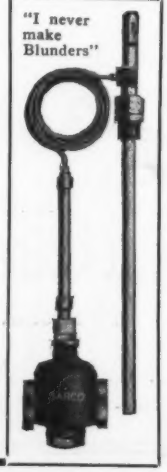
Every day, all over the country, mistakes of this kind occur, sometimes running into the thousands, simply because the management tries to make men do the work of a machine instead of putting the men on more important work. Mistakes of this kind cannot occur when temperatures are controlled by the infallible.

SARCO Temperature Regulator

Don't wait until it is too late. Don't procrastinate until the inevitable happens. Wherever uniform temperatures must be maintained, let the Sarco stand guard against excessive temperature variations and losses resulting therefrom.

In processes where excess of heat is not of itself detrimental, the Sarco makes big steam savings possible through close regulation.

Simplicity of principle and construction is the chief feature of the Sarco Temperature Regulator. It is entirely self-contained and does not depend upon auxiliary apparatus of any kind for its operation. A simple, practical, durable thermostatic device that quickly proves itself to be one of the most profitable investments you have ever made in plant equipment.



Operates on gas, steam or hot water heat within a range of 30° to 300° F.

To skeptics we offer the Sarco on 30 days' free trial without obligation. Write for full particulars and Booklet S-95.

Sarco Co., Inc.

183 Madison Avenue New York

BOSTON CHICAGO DETROIT
BUFFALO CLEVELAND PHILADELPHIA

Adolf Frese Corp., 726 So. Hope St., Los Angeles

Increase in Production of Asphalt Shown in 1926

According to a recent report from the Bureau of Mines, by G. R. Hopkins, petroleum economist, the production of asphalt in the American refineries in 1926 increased 9 per cent and imports increased 17 per cent.

Sales of asphalt and asphaltic materials manufactured from petroleum at refineries in the United States during 1926 amounted to 3,458,470 short tons. Of the total sales in 1926, 1,245,160 tons, or 36 per cent was reported as having been produced from domestic crude petroleum and 2,213,310 tons, or 64 per cent, produced from foreign crude petroleum.

The increase in the proportion of sales of asphalt from foreign petroleum in 1926 over 1925 indicates a tendency for the asphalt manufacturers to place more and more dependence on Mexican and Venezuelan crudes. The geographical distribution of petroleum asphalt production was unchanged in 1926, with the major portion of the sales on the Atlantic Seaboard, the Gulf Coast and California.

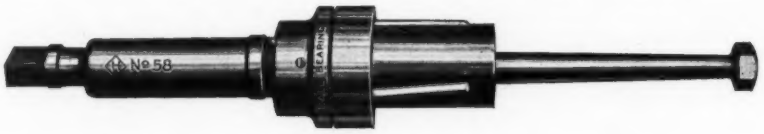
Imports of native asphalt and bituminous rock into the United States during 1926 amounted to 142,632 short tons, an increase over 1925 of 20,470 tons. There was received from Trinidad and Tabago 76,562 tons, or 54 per cent of the total, and from Venezuela 46,292 tons, or 32 per cent. Exports of petroleum asphalt reflected the growing output at refineries and increased 65 per cent over 1925. The total amounted to 146,589 short tons, valued at $3,183,746.

World's Largest High Pressure Plant

Los Angeles.—The new high pressure absorption gasoline plant under construction for the Cienga Corporation, Saticoy, Cal., is to be the world's largest high pressure plant. The plant will operate on dry industrial gas taken from the Ventura Fuel Company's gas line. It is expected to be completed and in operation during the latter part of June. It is being constructed by J. A. Campbell, natural gas engineer, of Long Beach, Cal., and is designed to handle 50,000 cubic feet of gas daily—which gas has previously been passed through low pressure absorption plants. The new installation will operate at 400 pounds pressure and will consist of Campbell "Oil Froth" equipment throughout. One of the special features of the installation is the utilization of wrought iron pipe for all cooling coils, which is expected to minimize corrosion troubles.

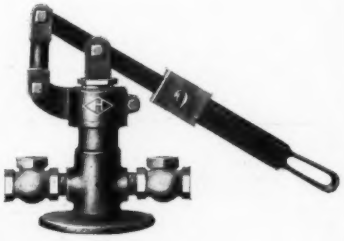
The Western Oil & Refining Company operating its refinery at Wilmington, California, has recently completed the laying of pipe lines from the refining plant to transport fuel oil and finished light oils to its export loading station on the channel.

HEAVY DUTY EXPANDERS FOR STILL TUBES



TOOLS FOR THE OIL INDUSTRIES

Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds.
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds.
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches



A. L. Henderer's Sons

Wilmington, Del.

Established 1870 Expanders since 1884

SEAMLESS STEEL STILL TUBES

Thousands of Babcock & Wilcox open hearth seamless steel still tubes are in service in refineries throughout the country.

These tubes have been supplied to various specifications, either with plain ends or upset as ordered.

Many of them are thirty feet long, made hot finished by a process perfected by this Company, for tubes of unusually long length.

The more common sizes are carried in stock at the Mill for immediate shipment.

THE BABCOCK & WILCOX TUBE CO

Works: Beaver Falls, Pa.

General Sales Office: 85 Liberty Street, New York

BRANCH OFFICES

CHICAGO .....Marquette Building
BOSTON .....80 Federal Street
PHILADELPHIA ..... Packard Building
PITTSBURGH ...Farmers Deposit Bank Building
CLEVELAND .....Guardian Building
CINCINNATI .....Traction Building
ATLANTA, GA. .....Candler Building
NEW ORLEANS .....344 Camp Street
HOUSTON, TEXAS.....Electric Building
SAN ANTONIO, TEXAS .....
.....511 Builders Exchange Building
DALLAS, TEXAS .....Magnolia Building

THE BABCOCK & WILCOX TUBE CO. TUBES

BRANCH OFFICES

GALVESTON, TEXAS .....414 Security Building
AMARILLO, TEXAS, ...208 Polk Street
PHOENIX, ARIZONA.....Heard Building
DENVER .....444 Seventeenth Street
SALT LAKE CITY .....Kearns Building
SEATTLE .....L. C. Smith Building
SAN FRANCISCO .....Sheldon Building
LOS ANGELES .....Central Building
PORTLAND, OREGON .....Gasco Building
HAVANA, CUBA .....Calle de Aguiar 104
SAN JUAN, PORTO RICO ..Royal Bank Building
HONOLULU, H. T.....Castle & Cooke Building

Important Consideration in the Design And Construction of an Oil Absorption Plant

(Continued from page 98)

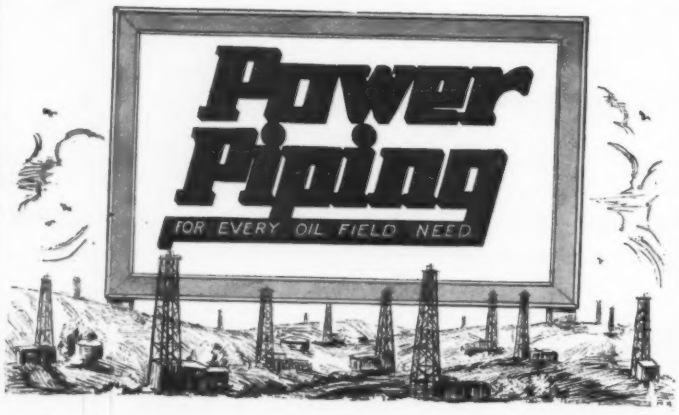
certain quantity of water in a cooling tower of proven efficiency and capacity; and second, the transfer of heat from one fluid of known properties, through materials of low heat transfer resistance, to water at a temperature range capable of accurate prediction. Moreover, those factors most vitally affecting heat-transfer efficiency, i. e. counter-current flow, relative fluid quantities, pressures, velocity and turbulence are largely subject to the choice of the engineer.

Cooling Towers

A great deal could be said for cooling towers for absorption plants. But there is one point in particular that should be emphasized; i. e. investment in equipment which provides plenty of good cold water under all conditions is one that really pays dividends to the gasoline plant operator. A cooling tower is one piece of equipment which should not be primarily considered from the standpoint of first cost. Operation and upkeep are usually very low. Consistent performance is what is wanted in a cooling tower installation because the overall plant efficiency is vitally affected.

Judging cooling tower performance offers many difficulties. In the first place, their design and construction is a specialized field. Statements regarding performance are hard to check due to the large number of important influencing factors, the combined effect of which determines the actual results obtainable. The accompanying curve for the course of cooling, vertically, through a certain type of deck tower, illustrates this point. The changing combination of conditions, while not greatly altering the characteristic sharp curve itself, changes the position of the curve in its relation to the efficiency scale.

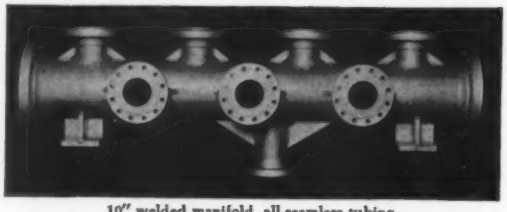
Points to observe in the judging of cooling towers, are details of design and construction which affect the consistency of performance. First, is there provision for free air circulation, even at low wind velocity? Second, are the materials of construction of long life? Third, is the distribution system at the top of the tower automatic and permanent; if sprays are used are they adjustable and do they require frequent cleaning? If troughs and weirs are used are they capable of being kept in perfect alignment horizontally? or will sagging between supports cause uneven spilling? Fourth, down through the tower, is the distribution kept even and is there anything to prevent drifting of the water away from the windward side of the tower? In the open type system the placement of the water with regard to the surface of the coils or cooling-sections is extremely important. The accompanying photograph shows an example of controlled distribution of cold water at the bottom of the tower.



Practical Solutions to Oil Field Problems

YOUR problem may be "peculiar"—you may feel its solution to be costly and complex—yet in just such cases *Power Piping* service proves itself! We can often meet the situation with a practical plan that will be found economical as well as efficient.

POWER PIPING CO. • PITTSBURGH



10" welded manifold, all seamless tubing, for high-pressure steam service

Quigley Specialty Man For South

New York.—Harrison W. Wood, who has recently joined the service staff of Quigley Furnace Specialties Company, Inc., will cover the Central, South and South Atlantic States. His headquarters will be Atlanta, Ga.

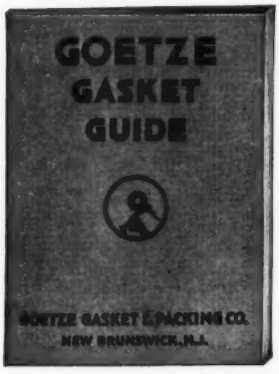
Mr. Woods has been for years identified with the manufacturing and sales departments of large industrials throughout the territory he is to cover for Quigley.

Quigley manufactures furnace refractories, guns, acid-proof cement, etc., and supplies much material to refineries throughout the United States.

The Union Oil Company of California has recently completed a new unit for the manufacture of asphalt paving materials, at its refinery at Wilmington, California. In addition to paving asphalt, the new installation will produce road oils.

Robert (Bob) Tucker, who has for some years been connected with the laboratory force at the Marcus Hook refinery of the Pure Oil Company, has recently been transferred to the Muskogee, Oklahoma, plant, in the capacity of resident chemist.

GOETZE

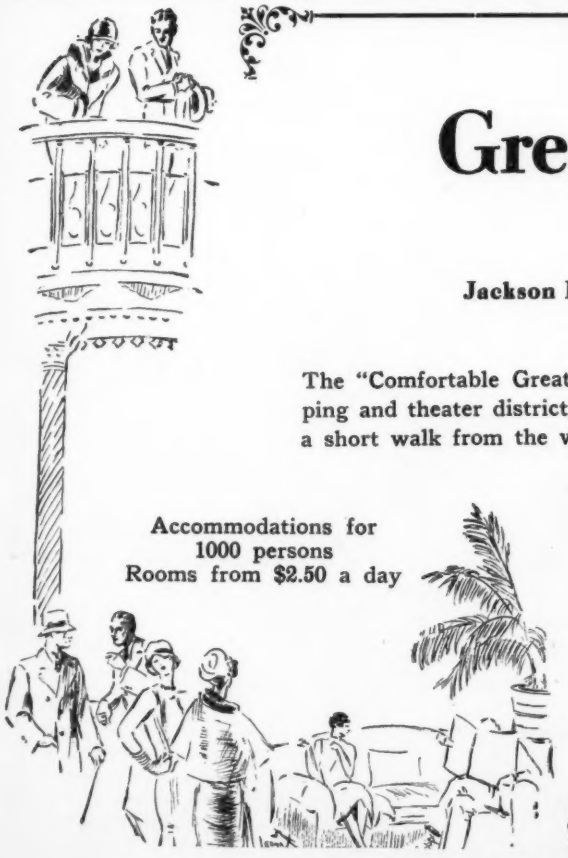


Metal-Asbestos Gaskets
for
Modern Refinery Practice

Write for this 36-page "Guide"

Goetze Gasket & Packing Co.

28 Allen Ave., **New Brunswick, N. Y.**



Great Northern
Hotel
CHICAGO

Jackson Blvd., Dearborn and Quincy Sts.

The "Comfortable Great Northern" is conveniently located in the shopping and theater district, two squares from the financial center and just a short walk from the wholesale section.

Accommodations for
1000 persons
Rooms from $2.50 a day

Here at rates considerably moderate are large, bright, livable rooms, excellent service and the conservation environment of a substantial business institution patronized by leading, conservative environment of a substantial distinguished guests with their families.

Throughout all departments, including the famously good restaurants, considerate moderation of charges prevails.

Mention Where You Saw the Advertisement

Extraction of Gasoline from Stripped Gas Made Profitable

MANY years ago certain astronomers studying the orbit of Uranus were puzzled by certain irregularities they found which were at variance with the known laws governing the orbits of planets. After a course of years and through the application of mathematical calculations they decided that another planet still farther out in the universe was existing, and after these calculations they were enabled to estimate the size, to arrive at is distance from the sun and it sorbit, and to instruct astronomers and astrologers as to when and where to point their telescopes so that they might see the new planet. This was done and the planet Neptune was discovered and later calculations have proven that its size and distance from the sun are exactly as the early astronomers estimated. In other words this planet of Neptune was discovered through mathematics only.

A little more than a year ago the engineering department of the Newton Process Company decided that there was good stable gasoline in appreciable quantities remaining in the natural gas after it was treated in modern gasoline extraction plants.

One line of reasoning was followed which pointed to the presence of additional gasoline over and above that indicated by the severest test methods and by the actual recovery of the most efficient gasoline plants. The theory which the engineers worked on was about as follows:—If a sample of high grade natural gasoline of say, around 85 deg. A. P. I. gravity was taken and carefully fractionated and condensed into very narrow cuts, it is found that the original sample of 85 degrees gravity gasoline contains in itself in a blended form, fractions with gravities running up to perhaps 130 degrees A. P. I. In this sample the very high or light material is blended down to lower gravity. This is known to be true.

The gallon of gasoline in natural gas is known to be the equivalent of about 25 cubic feet when in the vapor state. The natural gas under investigation has a gasoline content of one gallon of gasoline per thousand cubic feet.

There remains then, after the gallon of gasoline is extracted, about 965 cubic feet of gas. Was it not probable then, that this 965 cubic feet of natural gas might contain still further low gravity vapors in a greatly diluted condition? In other words, an appreciable amount of low gravity gasoline vapors remained in the residue gas, and these vapors were of such minority in the inter-mixture with the extremely light vapors remaining after the gas had been treated, that they were blended up in gravity to such an extent that their presence could not be detected, and they passed out of the absorption plant untouched. This would be just the reverse of the first condition cited above, where the light hydrocarbons of high gravity were blended down into a composite product of only 85 gravity. The small proportion of low gravity hydrocarbons escaping the action of the absorption plant would be reversely blended up in the remaining very light constituents which the plant operator does not desire.

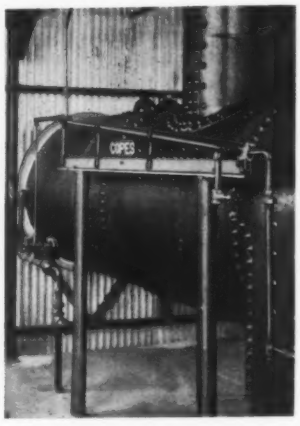
Test Method

Possibly the earliest form of test apparatus used with natural gas for the determination of gasoline content consisted of a small one cylinder compressor, operated at 50 pounds pressure. This test soon became obsolete and was superceded by the 250 pound test; then followed the charcoal test methods, condensing at atmospheric pressures, and finally the activated charcoal test which condensed at

COPES
Boiler Feed Water
Regulators

"Pay a higher dividend than any other piece of power plant equipment."

L. L. Baker, Chief Engineer
Barnsdall Refining Co.



The Copes Provides:

A simple, rugged, accurate and continuous boiler feed water input.

Even distribution of load between boilers.

Less drop in steam pressure on overloads.

Higher overload capacity.

Smooth, constant rate of feed with no spasmodic opening and closing of the feed valves.

Drier steam, since the water level cannot rise beyond a predetermined point.

Elimination of boiler priming and wet steam at the filter department.

Labor saving.

Reduced stress on boiler feed pumps, feed lines and valves.

The above statement by Mr. Baker is from an article he recently wrote on "Advantages of Boiler Feed Water Regulation in the Oil Industry." A copy of this will be gladly sent you for the asking.

NORTHERN EQUIPMENT CO., 620 Grove Drive, Erie, Pa.

Stock carried by B. W. Vinson, Natl. Bank of Commerce Bldg., Tulsa

SYSTEM OF BOILER FEED CONTROL

Standard Type
⅝" EMPIRE

EMPIRE

OSCILLATING PISTON
OIL METERS

So simple. Merely pipe the oil through the meter, and read off the amount registered plainly on the dial face. Nothing superior for pressure still work or other refinery needs.

EMPIRE meters are really "different", because by means of a simple and inexpensive adjustment they can be kept right up to their original high efficiency for remarkably long periods of hard service. This lasting accuracy is an outstanding and exclusive feature of the EMPIRE.

The Empire is a strong and durable meter. The design is simple, and all parts substantial. This means long life and low repair cost—two points for which the EMPIRE has held an unbeaten record for over forty years.

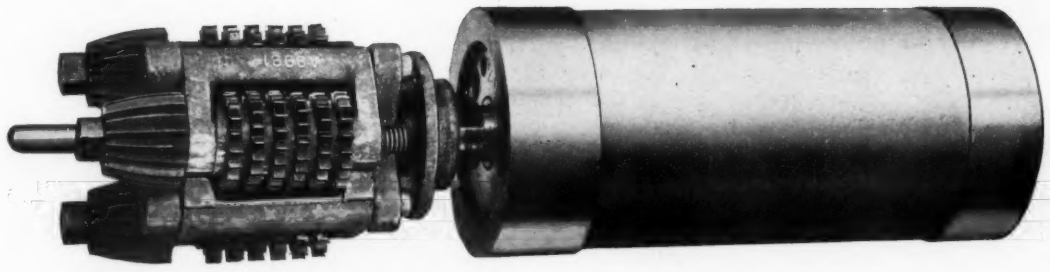
Send for fully illustrated catalog 110-R.

NATIONAL METER COMPANY

299 Broadway, New York

Chicago Boston Cincinnati Atlanta San Francisco Los Angeles

ROTO TUBE CLEANERS



Roto Air-Driven Heavy Duty Cleaner
For

CRACKING STILLS

THE ROTO CO. **Sussex Avenue and Newark St.,** NEWARK, N. J.

a pressure of 30 pounds per square inch. For a long time this test was looked upon as so severe that it was not given consideration by the great majority of gasoline manufacturers and engineers. At the present, however, the modern gasoline plants should equal, and in many cases, exceed in production, the 30 pound charcoal test. This latter method, although a severe test, does not indicate the actual or total recoverable gasoline content of natural gas. There is, as has been shown by recent plant installations, a certain amount of good gasoline present, which none of the present tests fully indicate.

Faced with the condition of "thinking" that this gasoline existed and yet being unable to detect its presence by even the most severe of the testing methods, the problem of its detection and recovery was approached from another angle. The treated, or residue gas, from gasoline plants was diluted with a lower boiling point hydrocarbon solution. This resultant mixture of vapors in a blended condition was subjected to gasoline extraction methods with the result that additional gasoline was recovered, and in this manner, what might be termed, the theoretical gasoline was proven to be present by its recovery.

One of the large companies on the West Coast became sufficiently interested in the new theory to devise a charcoal testing apparatus on a large enough scale to confirm the presence of this unknown gasoline content and to recover it in quantities sufficient to be analyzed. The results of this company's experiments indicated that in the operation of their most efficient plant, they were still leaving approximately one-third of a gallon of commercial natural gasoline in each 1000 cubic feet of gas treated. The product recovered through these experiments was surprisingly stable and not a "wild" gasoline.

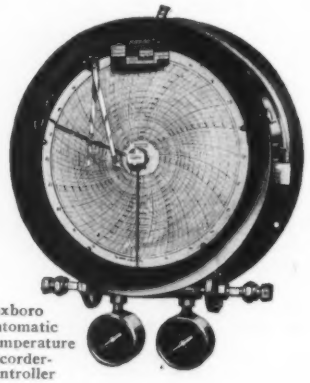
After a few months of further experimenting the theory of additional gasoline extraction was put into practice on a large scale in a plant which was designed to operate on previously treated or residue gas. This gas, which had once been through gasoline absorption plants, was found to indicate a gasoline content of around one tenth of a gallon of gasoline per thousand feet when tested with the charcoal test with distillation at 30 pounds pressure. The standard charcoal test with distillation at atmospheric pressure showed this gas to be dry.

When the plant was installed and put into operation on recovery the gasoline was fifteen one hundredths of a gallon per thousand cubic feet of gas treated, or five one hundredths of a gallon higher than the 30 pounds charcoal test. The gasoline was a stable commodity. Residue gas leaving this plant was still found to contain one tenth of a gallon of gasoline per thousand feet with the 30 pound charcoal test. Thus it appears that more good gasoline is recovered by plant operations than is shown by the most severe test, and this recovery is obtained without showing a reduction in gasoline content by the same test methods. This seeming paradox is explained in a previous paragraph.

The next plant for the extraction of gasoline from residue gas was built at Newhall, California, to operate on natural gas in transit to Los Angeles which was considered dry. This plant is operating on about 30,000,000 cubic feet of gas and its net production is 4500 gallons of stable gasoline per day. The installation is showing a handsome profit, after paying a royalty of about 25 per cent for the privilege of treating the gas.

It is seemingly necessary in this type of installation to use a light kerosene stock as an absorbing medium in order to be able to make this extraction at all. While the light series in the absorbing medium must be present to absorb this light gasoline, they are also necessary in the subsequent distillation procedure to provide a blending medium to hold this gasoline and recover it in the form of production. When operating with a high initial boiling point absorption medium these vapors are not condensed, and pass away with the other uncondensed vapors. Because the charcoal testing methods also use the distillation procedure in their recovery they have this same limitation and do not show this series as a gasoline,—and as a result, to all intent and purposes, the additional recoverable gasoline, does not exist. The product as finished in the plants discussed above usually has a gravity of about 85 degrees A. P. I. and end point of about 275 degrees F. and an initial boiling point of around 65 degrees F.,

Wax Sweating *Needs* This Control



Foxboro Automatic Temperature Recorder-Controller

Wax sweating is another refinery process where close temperature control shows immediate profits.

Foxboro Time Temperature Recorder-Controllers reduce the time required for sweating, making possible a larger output in a given time. A closer cutting of the wax and a more uniform product are made possible by exact control of the melting point. It goes without saying that steam consumption and labor costs are reduced.

When set, Foxboro Controllers hold the temperature to the exact degree desired for the exact time period. They also furnish an accurate and permanent record of the process. Like all Foxboro Instruments, Time Temperature Controllers are guaranteed permanent in calibration and are accurate to within less than 1 per cent of total scale range.

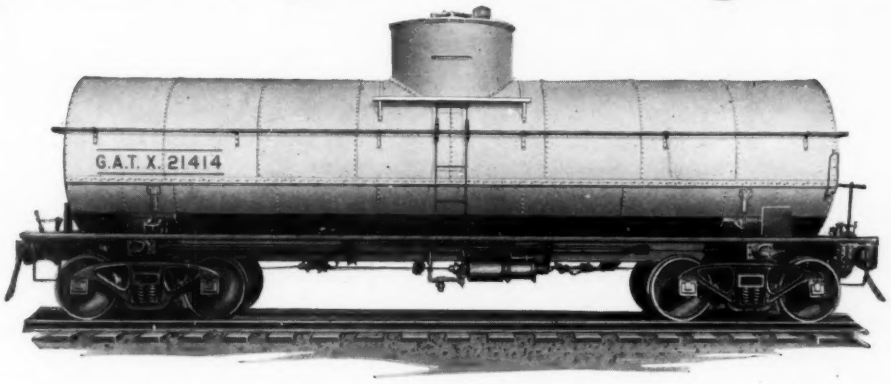
THE FOXBORO CO., INC.

Neponset Avenue, Foxboro, Mass., U. S. A.
205 So. Cheyenne Avenue, Tulsa, Okla.

New York Chicago Boston Philadelphia Pittsburgh
Cleveland Rochester Atlanta Los Angeles
Detroit San Francisco Portland, Ore

FOXBORO
REG. U.S. PAT. OFF.
THE COMPASS OF INDUSTRY

EFFICIENT DEPENDABLE SERVICE



TANK CARS *of* ALL CLASSES BUILT *and* LEASED

For the TRANSPORTATION of LIQUID COMMODITIES

GENERAL AMERICAN TANK CAR CORPORATION

General Offices: ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILL.

BRANCH OFFICES:

Eastern Offices: 17 Battery Place, New York; Munsey Building, Washington, D. C.

Midwestern Offices: 1946 Railway Exchange, St. Louis, Mo.; 901 Cosden Bldg., Tulsa, Okla.

Southern Offices: Union Indemnity Bldg., New Orleans La.; Magnolia Bldg., Dallas, Texas

Pacific Coast Office Bartlett Bldg., Los Angeles, California

PLANTS: EAST CHICAGO, IND. GOOD HOPE, LA. WARREN, OHIO FORT WORTH, TEXAS SAND SPRINGS, OKLA. WICHITA FALLS, TEXAS

REPAIRING DONE AND REPAIR PARTS CARRIED IN STOCK AT ALL PLANTS

THE REFINERY SUPPLY COMPANY

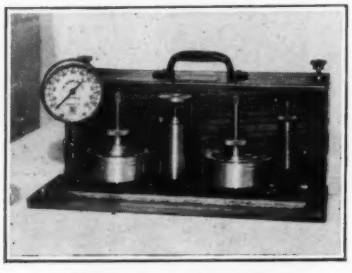
4th and Detroit
Tulsa, Oklahoma

917 Santa Fe Bldg.
Dallas, Texas

Largest Scientific Material House in the Southwest

Thermometers :: Recorders :: Controllers

Net Weight of Tester in Case 21 Lbs.



The R. S. PORTABLE DEAD WEIGHT GAUGE TESTER

The R. S. FRASER PETROLEUM CALCULATOR

Bulletins on Request

with about 87 per cent recovery upon Bureau of Mines Distillation.

Thus, it is said, a Neptune has been found in the gasoline world and discovered by calculation and theory, since it was difficult to detect its presence by test methods, either then or now, but being able to extract and recover it by actual gasoline plant operation.

Construction work on the installation of cracking units at the El Segundo refinery of the Standard of California has been stopped and the work is held in abeyance, to be resumed when the company abandons its present program of retrenchment.

American Radiator Staff Changes

American Radiator Company announces the following changes in the sales personnel of the industrial division:

C. A. Olson, who has been with the American Radiator Company in the Mid-Continent oil field, has been transferred to cover the refineries in Western New York and Pennsylvania with headquarters at the American Radiator Company, 1807 Elwood Ave., Buffalo, N. Y.

Dale S. Miles, formerly with the Empire Refineries of Tulsa, will represent the American Radiator Company in Kansas, Oklahoma, Missouri and Wyoming, with headquarters 935 Kennedy Building, Tulsa.

E. H. O'Connell, formerly with headquarters in Kansas City and calling on refineries in the Mid-Continent field, has been transferred to the Pacific Coast, where he will make his headquarters in the American Radiator Company offices in the Quinby Building, Los Angeles.

Gray I. Morriss will continue to work out of headquarters of the industrial division of the American Radiator Company at 816 S. Michigan Avenue, Chicago, calling on the refineries in Illinois, Ohio, Indiana, Kentucky, Arkansas, Texas and Louisiana.

Edward Forged Steel Valves

—the best valve for refinery service.

Designed and built for service up to 500 pounds pressure and intermittent temperature to 1100° F.—they will fit any requirement.

—low in price—standardize on them.

Because of quantity production, these high grade valves are priced remarkably low and can be used anywhere—effecting a highly efficient service at an economical cost.

—prompt shipment from stock.

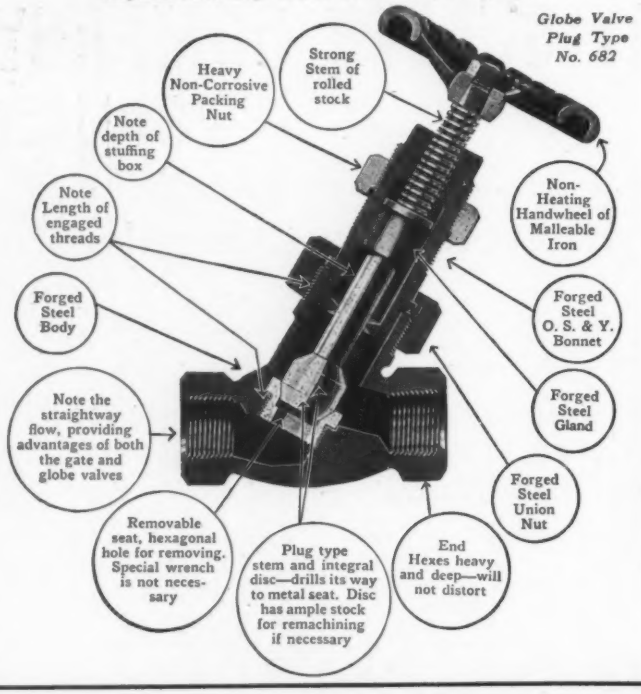
Globe and Angle—from ¼" to 2" inclusive.

The Edward Valve & Manufacturing Co.

Main Office and Works, East Chicago, Ind.

Maintenance Engineering Corp., 1802 Conti St., Houston, Texas

Chapman Valve Mfg. Co., P. O. Box 974, Tulsa, Okla.


Globe Valve Plug Type No. 682
Heavy Non-Corrosive Packing Nut
Strong Stem of rolled stock
Note depth of stuffing box
Note Length of engaged threads
Non-Heating Handwheel of Malleable Iron
Forged Steel Body
Forged Steel O. S. & Y. Bonnet
Note the straightway flow, providing advantages of both the gate and globe valves
Forged Steel Gland
Forged Steel Union Nut
Removable seat, hexagonal hole for removing. Special wrench is not necessary
Plug type stem and integral disc—drills its way to metal seat. Disc has ample stock for remachining if necessary
End Hexes heavy and deep—will not distort

—for every refinery service

Air Cooler Bulletin

The use of generator air coolers is steadily increasing as the advantages of a dust-proof, moisture-proof and fire-proof closed cooling system for generator windings are becoming more generally appreciated.

The Griscom-Russell Company has just published a new bulletin on this subject which is of interest to all power plant executives and engineers. This bulletin explains the application of generator air coolers, describes the special features of the U-fin Cooler, includes a list of representative central stations and industrial plants equipped with this apparatus, and contains several illustrations of typical installations and arrangements.

Free copies of this bulletin may be obtained by writing to the Griscom-Russell Co., 285 Madison Ave., New York City.

The Electric Controller & Manufacturing Company, of Cleveland, Ohio, announces the appointment of the Petroleum Electric Company, 217 East Archer St., Tulsa, as their representatives in Oklahoma and the Panhandle district of Texas.

Hill-Hubbell & Company, of San Francisco, manufacturers of paints, varnishes, enamels and biturine coatings for pipelines, have established an office at 1006 Washington Avenue, Houston, Texas, in charge of Ralph B. Wade.

E. K. Pierce has recently been appointed manager of the Fittings division of The Ohio Steel Foundry Company, Springfield, Ohio. Before his association with his present company, Mr. Pierce was in the refinery division of The M. W. Kellogg Company.

The southwestern district sales office of the Chicago Bridge & Iron Works which for the past several years has been located in the Praetorian Building in Dallas has been moved to the Dallas National Bank Building in the same city.

Paul H. Start, formerly chemist for the National Refining Company at its Coffeyville, Kan., plant, has resigned from this position to enter the employ of the Crown Central Petroleum Company as chief chemist at its Houston, Texas refinery.

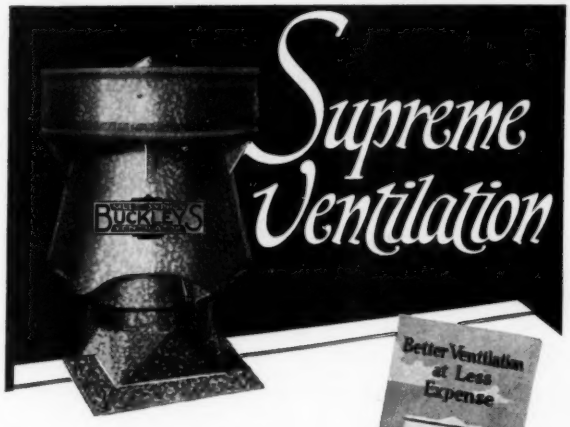
BUCKLEY'S

MULTI-SYPHON

VENTILATORS

Are now being used throughout the United States and five foreign countries in **serving the oil industry.**

There's A Reason!



"BETTER VENTILATION AT LESS EXPENSE,"

which gives you full details as to construction, theory, material, capacities, weights and prices.

Write for catalogue.

Manufactured only by

The American Cornice Works Co.

Wichita, Kansas

WALSH FIRE BRICK

FROM COAST TO COAST

WALSH FIRE CLAY PRODUCTS CO.

ST. LOUIS
CHICAGO
360 N. MICH. BL.
NEW YORK
220 FIFTH AVE.

78 Oil and Refining Companies now using the

Mettler Entrained Combustion Gas Burners

For All Purposes, Kinds of Gas, Pressures

Write for Latest Condensed Catalog

Lee B. Mettler Co.

406 S. Main St. Los Angeles, Cal.

Resistance
to fatigue...

DBC

METALLURGISTS say that Aluminum Bronze has extraordinary resistance to fatigue and to alternating stresses.

This quality is demonstrated by its service as the material for the worm gears of Ford 1-ton trucks.

It has also great resistance to acid and corrosion.

It is the ideal material for many parts of oil refinery equipment.

We furnish thousands of studs, such as are illustrated, holding-down bolts and other parts to large refining companies.

Send specifications for estimate

Buffalo Bronze Die Cast Corporation
100 Arthur Street Buffalo, N. Y.

Refining Capacity Shifting to Integrated Companies

(Continued from page 54)

Oklahoma, but with the exception of the small refining capacity of the state of Arkansas.

Trend in the Chicago Territory

The integrated type of company in the district about Chicago has shown a steady development of business and plant enlargement. In 1924 there were five integrated company refineries operating in this section with a rated capacty of 104,000 barrels. Durng the past three years but two more companies of this type have entered the district with refineries, but the expansion programs of the group of seven companies has resulted in an increased capacity of the integrated company from 104,000 barrels to the present rating of 180,000 barrels.

The non-retailing type of company operating in this district has shown a distinct falling off of total capacity. In 1924 there were six plants dependent upon the jobber and similar channels for their outlet, with a total capacity of 24,500 barrels. However, during the past three years their number has decreased to three plants, with a total capacity of but 4200 barrels, which indicates a decrease in the "non-retailing" capacity of 20,300 barrels.

The six shut-down plants, having a total capacity of 7300 barrels, were all formerly in the non-retailing class, but their length of shut down period is indicative that they should not again enter the field as active refineries.

In this territory the Mid-United States refining installations of the larger integrated companies are in predominance. Roxana, Standard, The Texas Company and Sinclair having the majority of the capacity, while Lubrite, Bartles-McGuire and Indian Refining Company make up the remainder.

These large companies through the installation of major refineries adjacent to the great market for refined products in the central Great Lakes area, provide an example of the tendency among refiners to construct their plants as near as possible to the most advantageous point or district of distribution. Instead of building plants in the interior, refining crude at its source of production, there is a decided tendency to pipe the raw petroleum to the market centers there to refine it and distribute over short hauls in the more densely populated areas. This scheme effects the saving between the comparatively high freight rate on finished petroleum products and the relatively low cost of pipe lining crude oil. Again there is better economy in shipping the finished materials over short hauls in tank cars and trucks from the centrally located refining plant, as against the high rate of freight on finished gasoline from the Mid-Continent and other inland producing areas.

Such concentration of refinery ca-

pacity is not only much in evidence in the Chicago district, where refining capacity has increased from 128,500 barrels in 1924 to 184,200 barrels in 1927, but it is also apparent in the Gulf Coast area of Louisiana and South Texas, as well as in New Jersey and New York. The refining district comprised by the latter two States has long been in existence and since 1922 there has been no appreciable increase in skimming plant capacity in either New York or New Jersey. Refinery capacity in New Jersey has shown an increase since 1924 of 24,000 barrels—but the total skimming plant refinery capacity for New York and New Jersey total slightly over a quarter of a million barrels. The principal item of expansion in these districts lies in the large installations of cracking units by the four or five major companies operating these plants. The cracking capacity of these plants at present totals 151,900 barrels for the district, and this added to the skimming plant capacity is indicative of the magnitude of the refining district centered around New York City. The combined total capacity being 402,900 barrels.

The first mentioned district of refinery capacity concentration, made up of South Louisiana and South Texas and termed the Gulf Coastal territory has shown a more remarkable development in recent years.

In South Louisiana, 1927, there are six operating plants with a total capacity of 152,500 barrels, while in South Texas the 13 operating plants provide a capacity of 352,300 barrels, bringing the total Gulf Coastal capacity to over a half million barrels. In 1924 South Louisiana with five plants contributed 112,100 barrels capacity, while South Texas, with 18 plants, had a capacity of 303,300 plants, the total then being 415,400 barrels. In the entire Gulf Coast area, New Orleans and vicinity, and Houston and Beaumont refining districts, there was a gain in capacity through the expansion and enlargement of the 19 plants operating in the territory which amounted to 89,400 barrels increase during the past three years. At the same time there was a loss in the number of operating plants from 23 to 19.

The Gulf Coast area is speedily becoming a local market of much importance, and while the concentration of refining capacity in the coastal area is steadily increasing it is due to the growth and development of export business more than to the development of local markets. The refineries are all at the ocean end of a vast system of pipe lines extending far northward into the great producing area of Texas, Oklahoma, Louisiana and Arkansas—with the beneficial effect of lower cost of transporting crude petroleum to the export terminal, as against the higher cost of transportation finished refined products by rail to these shipping points.

SOUTHERN CORNICE WORKS

Manufacturers of

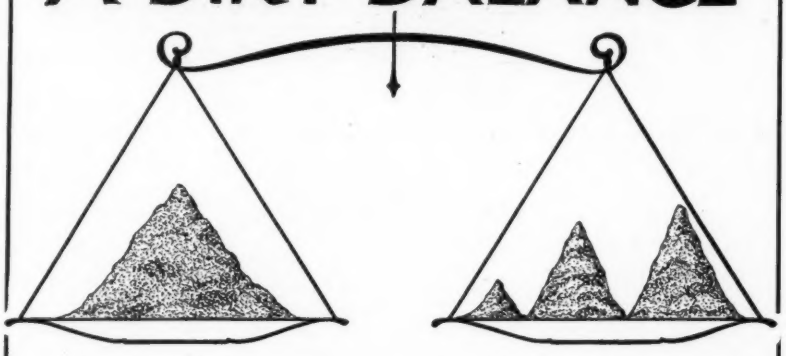
"SOCO" STATIONARY AND REVOLVING VENTILATORS

For Refinery
And Natural Gasoline Plants

Oil Field Work A Specialty

Phone 2-1546 TULSA, OKLAHOMA 118-20 S. Cincinnati

A DIRT BALANCE



Impurities in feed water = *scale* + *blow down* + *carry-over to steam lines*

USE the Tracyfier to protect your steam lines, valves, traps, engines, turbines and stills against carry-over of water and impurities from your boilers. Standard Specification Steam from Tracyfiers assures lowered maintenance costs, improves fuel costs on combination fire and steam stills and affords maximum protection of stills from "slugs" of water.

The coupon is for your convenience. Clip it.

Andrews-Bradshaw Company
533 Fourth Avenue,
PITTSBURGH, PA.

With No Obligation I Would Like to See a "Dirt Balance," and Learn How The Tracyfier Insures Against Slugs of Water

Name ..... Title.....

Address .....

Company .....

MAR·LEY

The OPEN TYPE SPRAY NOZZLE

A PERFECTED DESIGN

THE design of the Marley is correct. Usage proves it. The large rectangular venturi shaped inlet throat and the large bottle shaped upper whirl chamber permits of large free passages which prevent clogging and reduces friction. Notice there are no internal parts.

MAR·LEY

Spray Cooling Equipment

Marley Spray Cooling Equipment was designed by engineers of long experience in spray pond activities. It has proven in a number of installations that it aids in getting greater quantities of water, with lower pressure, and less clogging. It also reduces the cost of material and labor required for installation.

An Engineering Service, Too

Marley engineers by reason of their long experience as spray pond engineers are ably equipped to investigate, recommend and guarantee efficient spray pond installations or spray cooling equipment. They will be glad to do this too. Feel free to write.

CATALOG

Power Plant Equipment Company
KANSAS CITY, MO.

EXTRACTS OF REFINING TECHNOLOGY

Sand Content of Machine Grease.—Ten grams of the grease are extracted with benzyl alcohol and finally with hot water, and the residue is dried and weighed. The presence of sand grains being established by touching the residue, heated to glowing point, with a glass rod, the residue is treated with hydrochloric acid, filtered and the remaining residue after identification as sand under the microscope, is weighed. Amounts of sand, varying from 0.009 to 0.057 per cent, have been found in samples of grease examined. There was no direct relationship between the percentage of sand and the number of grains present, as determined by the microscope method. Chemiker Zeitung, 1927, volume 51, page 54.

* * *

Anti-Knock Materials.—The results of Charch, Mack and Boord are discussed (see Berichte 1926, page 570). The efficiency of lead tetraethyl being taken at 100, a table of comparative efficiencies is given. While compounds of quadrivalent lead show anti-detonating properties, those of bivalent lead, with some exceptions, have no action. Lead benzaldehyde, lead diphenylnitrate, tin bromide, ferric chloride, aluminum triethyl and chloride, and bismuth triphenyldichloride have no anti-knock or anti-detonating action. The anti-detonating action of substances on an acetylene mixture in an explosion tube varied greatly from results obtained from the motor. A direct relation was shown between intensity of detonation and electric conductivity of cylinder gases. The most powerful anti-knock materials deposit finely-divided particles of the metallic constituent on heating, and such compounds as undergo complete oxidation on heating are inefficient. Detonation is a consequence of the electric charge, rather than of the conductivity of the gases. Petroleum Zeitschrift, volume 22, pages 1344 to 1347.

* * *

Action of Gaseous Hydriodic Acid on Petroleum.—An interesting investigation has been made on the action of gaseous hydrogen iodide (hydriodic acid) on petroleum derivatives which contain sulphur. The importance of this theoretical investigation involving the reaction between the acid and the sulphur-containing substances in petroleum is that it can be used in reducing the sulphur content of petroleum distillates. Thus it has been stated that in one experiment the reduction in the sulphur content effected in this manner amounted to as much as 20 per cent.

It was found that aliphatic sulphur compounds do not react with dry hydrogen iodide. Aromatic compounds containing sulphur evolve sulphuretted hydogen more or less readily. Thiophen reacts at once, even in cold dilute solution, with separation of carbon, iodine and sulphuretted hydrogen. An aqueous solution of hydriodic acid only reacts with thiophen if the mixture is heated in a sealed tube at a temperature of 140 degrees C. The reaction occurs in two stages; in the first, sulphur is removed from the ring; in the second, the liberated iodine attacks the hydrocarbon residue. The separated carbon contains much adsorbed iodine and sulphur. Furan and methylfuran act in the sace manner. Chem. Weekblad, 1927, volume 24, pages 102-5.

* * *

Determination of Paraffin scale in crude paraffin.—A small fireclay crucible, thoroughly porous, glazed on the side, but unglazed at the bottom, is inverted on a cork, through which a tube communicates with a vacuum flask. By the use of gelatin a space is moulded on the bottom of the crucible, and is filled with wax mass. The adherent oil is drawn into the flask through the porous base of the crucible, the oil removed and the amount of scale determined by difference. Petroleum Zeitschrift, volume 22, pages 1347-8.

* * *

Separating Liquid Hydrocarbons from Mineral Matter.—Mineral matter which contains oil is ground under water and a part of the oil is separated. The material then undergoes further mechanical treatment, during which the oil collects in drops on the surface of the water while the mineral matter sinks to the bottom. French Patent No. 607,269.

* * *

Adsorption of Resins by Paraffin.—The solidifying point of residues, which contain paraffin and resins, is dependent on prolonged heating. Thus a mazut, after being heated at a temperature of 60 degrees C, shows a maximum congelation point of 25 degrees C, after heating up to a temperature of 100 degrees C, a minimum congelation point of minus 2 degrees C. The congelation point is raised up to a temperature of 25 to 27 degrees C by the removal of the resins, while it is almost unaffected by the preliminary treatment. The congelation point is however decreased by the removal of a large part of the ozocerite, the reduction amounting to from two to 15 degrees C. However the relationship between the preliminary heating

METALASTIC

Prevents Wear on Sleeves of Centrifugal Pump Shafts!

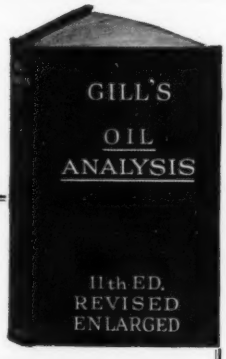
Patented and Patents Pending In the United States and Foreign Countries

OVERTIME

for repairs to feed pumps is eliminated, because shaft sleeves last for years with **METALASTIC** in the stuffing-box.

METALASTIC INCORPORATED
JERSEY CITY, N. J.

The Standard Short Hand-Book for Chemists and Engineers



Eleventh Edition Revised and Enlarged

OIL ANALYSIS

AUGUSTUS H. GILL, S.B., PH.D, Sc.D.

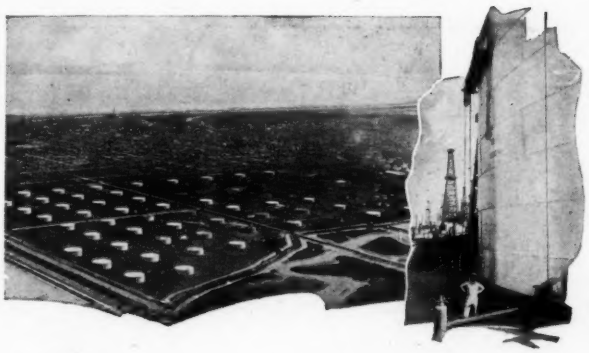
28 Illustrations. 18 Tables. 293 pages.

One of the few chemical books which is simple enough to be taken up without immediately previous preparation in the intervals of an engineer's work. It treats a restricted field of engineering chemistry in a practical and utilitarian way. It is a concise manual for the analysis of the commonly occurring animal, mineral and vegetable oils, and in addition to describing the methods used in applying physical and chemical tests, gives particulars regarding their preparation, properties, analytical constants, uses and adulterants.

Two new chapters have been added to this edition—one a brief statement of the composition of the different oils; the other, the methods of examination of Motor Gasoline and Fuel Oil. The special tests, methods of analysis and the description of the special oils and greases have been revised where necessary to bring the book throughly up-to-date. As many of these tests have become standardized by government bureaus and testing societies, they are reprinted as given in their publications. **[Price $4.00]**

For Sale by

The Gulf Publishing Company
1716 Dallas Avenue, Houston, Texas



Why repaint every year?

CLEAN, good-looking storage tanks are a business asset. Most oil concerns recognize this fact, and spend considerable money in repainting to keep such equipment attractive.

But, in many cases, repainting is often unnecessary, and can be avoided by *cleaning* painted surfaces with OAKITE materials. Many oil concerns have reduced, substantially, their repainting costs by cleaning their equipment the OAKITE way.

OAKITE cleaning restores the old paint by removing completely every bit of discoloration, oil, dirt, and weather stains. Brings out the original color. Makes old paint like new.

Write today for booklet "CLEANING IN THE OIL INDUSTRY". It gives all the facts, or ask to have our Service Man in your locality call. No obligation.

OAKITE IS MANUFACTURED ONLY BY

OAKITE PRODUCTS, Inc., 50B Thames St., NEW YORK
(Formerly OAKLEY CHEMICAL CO.)

Oakite Service Men, cleaning specialists, are located at

Albany, Allentown, Pa., Altoona, Pa., *Atlanta, Ga., Baltimore, Birmingham, Ala., *Boston, Bridgeport, *Brooklyn, Buffalo, Camden, Charlotte, N. C., *Chicago, *Cincinnati, *Cleveland, *Columbus, O., *Dallas, *Davenport, *Dayton, Decatur, Ill., *Denver, Des Moines, *Detroit, Erie, Pa., Flint, Mich., Fresno, Cal., *Grand Rapids, Harrisburg, Hartford, *Indianapolis, *Jacksonville, Fla., *Kansas City, *Los Angeles, California; Louisville, Kentucky, *Memphis, Tenn., *Milwaukee, *Minneapolis, *Montreal, Newark, Newburgh, N. Y., New Haven, *New York, *Oakland, Cal., *Omaha, Neb., *Philadelphia, Pittsburg, Portland, Me., *Portland, Me., *Portland, Ore., Providence, Reading, Rochester, Rockford, Rock Island, San Francisco, *Seattle, *St. Louis, South Bend, Ind., Syracuse, *Toledo, *Toronto, *Tulsa, Okla., Utica, *Vancouver, B. C., Williamsport, Pa., Worcester.

*Stocks of Oakite materials are carried in these cities.

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Industrial Cleaning Materials and Methods

and the congelation temperature did not disappear, and finally, independently of heat treatment, the temperature is brought up to 14 degrees C by removal of the resin as well as of the high molecular weight paraffin. Among other things the author sought for an explanation of the dependence of the congelation point on the preliminary heating, with the idea that the adsorption of the resin in paraffin plays a certain role. Neft. i. slanc. Choz., volume VIII, pages 640-6, Chemisches Zenthralblatt, 1926, volume I, pages 1910 ff.

* * *

Continuous Distillation of Crude Oil.—Crude oil and other complex mixtures of hydrocarbons are passed through a series of stills which are connected with one another and these liquids are maintained at temperatures, which increase in regular order from the first to the last still. Hence the series of stills or vessels corresponds to a series of condensers and rectifiers, all of which are connected together. The number of condensing and rectifying units is independent of the number of stills and each still is connected with its own condensing and rectifying apparatus, but in such a manner that the rise in the temperature in the condenser and rectifier takes place in the same sense as in the stills. Each condenser and rectifier can be operated either with the still, with which it is connected, and with the neighboring still as well, or with the still which is connected with the neighboring condensing and rectifying apparatus. The essential, technical effect, which is obtained in this arrangement, is such that it is possible to shunt out one or more condensers from the series, without disturbing in any important way the progress of the distillation. This is accomplished by means of a simple manipulation of the valves, which are on the condenser lines and on the lines within the condenser. The result is that the quantity and the composition of the condensates can be changed without interrupting the progress of the distillation. German Patent No. 437,796.

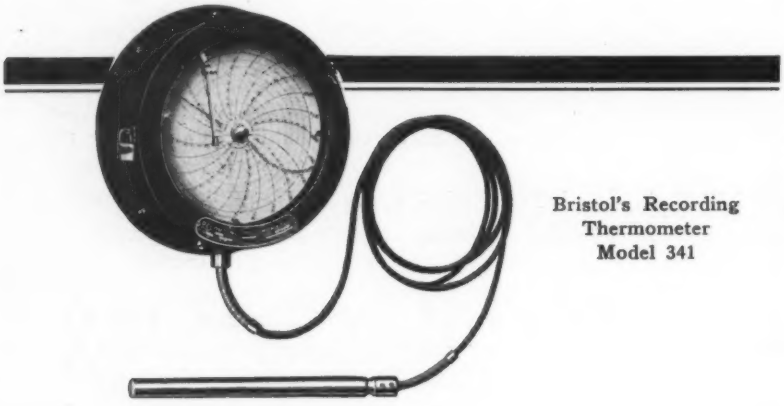
* * *

Distillation of Oil Chalk with Heated Gas—Experiments are described on the distillation of an oil-bearing chalk found in Germany. By distilling the material at a temperature of 420 degrees C in a vertical retort which is heated internally by the passage of a current of hot inert gas the oil is completely removed with a minimum of decomposition. For material containing 18 per cent of oil and three per cent of water the gas, an oxygen-free flue gas, enters at a temperature of 520 degrees C and leaves, with the products of distillation, at about 150 degrees C. The material has a tendency to cake, but no difficulty is found in passing the gas current through it. The retort, or at least the upper part of it, should, however be lined with wrought iron to prevent sticking. The oil is of better quality and in particular possesses a higher lubricating oil content than that obtained by distillation in an externally-heated rotary retort. Brennstoff-Chemie, 1927, volume 8, page 5 to 8.

* * *

Asphalt Content of Mineral Oil—There are five different ways in which the asphalt content of mineral oils can be determined, namely, the benzine process, the alcohol-ether process, the amyl alcohol, acetic ester and butanon methods, and all of these methods give results which do not agree with one another. Tests made on a crude oil showed that the benzine method gave the lowest values and the amyl alcohol the highest values, namely 0.9 per cent and 22.4 per cent.

Variations in these results were therefore very great. It appeared necessary to investigate the character of the asphalt deposit. This deposit can contain asphaltenes, petroleum resins and mechanically retained hydrocarbons. Asphaltenes are characterized by being difficultly soluble in benzine and petroleum resins are soluble in benzine, but by treatment with kieselguhn they can be rendered insoluble. It was determined therefore that the deposit obtained with amyl alcohol was a mixture of asphaltenes, petroleum resins and hydrocarbons. The asphalt that was extracted with the aid of butanone, amyl acetate and alcohol ether were



Bristol's Recording Thermometer Model 341

Keeping Watch Over Condensing Water Temperatures

Efficient refineries keep an accurate check on the temperature of water in cooling towers because if the temperature here is too high it means a severe loss in the product.

There is no better way of knowing at once any increase in temperature than with

Bristol's Recording Thermometers

They are accurate and dependable and warn you in time to prevent any of your gasoline going back with the residue gas.

Our Sales engineers will recommend the instrument best suited for your requirements.

The Bristol Company Waterbury, Connecticut

FOR 38 YEARS — Ask Any Technical Engineer — MAKERS OF

BRISTOL'S RECORDING INSTRUMENTS

Boston
New York
Philadelphia

Pittsburgh
Birmingham
Detroit
Chicago

St. Louis
Denver
San Francisco

Pack them to stay packed

CRANEUM

It was bound to come! A packing that would stand up to modern service requirements on air and gas lift compressors and hot oil plunger pumps

—*And here it is!* Craneum. Thousands of pounds going out to the refineries. Giving better service than ever before seen on gas compressors and hot oil pumps in cracking for temperatures up to 900 degrees F. and 1600 pounds.

Braided copper jacket wears through quickly, giving the rod surface a cool, non-frictional face of finely divided metal, graphite and heat resisting material.

Used extensively on Worthington, Union, Wilson-Snyder, Chicago Pneumatic and other standard equipment on all the oil fields.

Order from jobber or direct.

CRANE PACKING CO., 1808 Cuyler Ave., Chicago, Ill.

"John Crane" Metallic Packing

Universal Mist Extractor

Endorsed and adopted by Producers, Refiners and Engineers BECAUSE

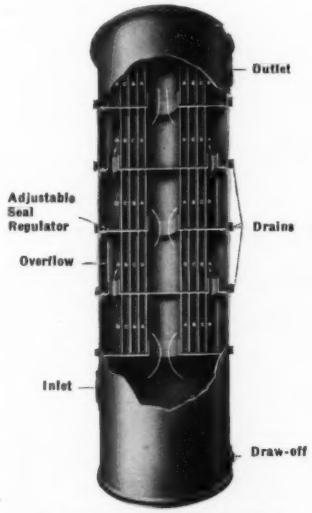
It provides **CLEAN** gas for the Absorption or Casinghead plant.

Does away with **LIVERED** absorption oil.

PREVENTS stills from **FOAMING.**

It insures **CLEAN** gas for distribution lines and **ADDITIONAL OIL** for the producer.

Removes **WATER** from gas leaving Charcoal Absorption Plant.



White Arrow Shows Path of Gas

It will, in refineries, result in lower end points, less treating and higher yields.

Can be used to remove suspended oil from "tail-house" gases.

Can be installed for pipe or cylindrical stills to remove all unvaporized oil held in suspension before vapors reach dephlegmators.

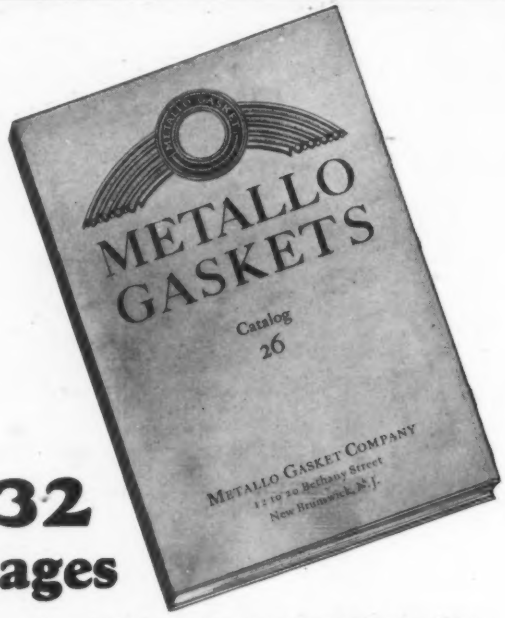
It operates under pressure or Vacuum.

It operates without excessive back pressure.

For sizes, specifications, prices and further information write to

OIL ENGINEERING COMPANY

WRIGHT-CALLENDER BUILDING **LOS ANGELES, CALIFORNIA**



32 pages

of useful information on gaskets and valve discs for all industrial services and valuable data and tables in this book we send free on request.

METALLO Gasket Co.

New Brunswick, N. J.

For Protection

When paint spraying outside work use the New Improved Pulmosan Dustproof Aluminum Respirator.

For painting inside of tanks and tank cars use the Pulmosan Airline Mask with blower attachment.

Write for Descriptive Literature

Pulmosan Safety Equipment Corp.

384 Jay Street Brooklyn, N. Y.

found to be mixtures of asphaltenes and petroleum resins. Only the asphaltenes were considered to be injurious, in other words the hard asphalt. Hence on'y the benzine-insoluble asphal was determined for a long time. The normal benzine process however does not give quantitative results. A portion of the asphaltenes remains at all times in the benzine soluble oil. Complete precipitation is attained nevertheless by means of the iron chloride method which is described in the following. It was also determined that the asphaltenes are converted into difficultly-soluble iron compounds by means of the iron chloride, while the petroleum resins and the hydrocarbons are not precipitated.

The method of working is as follows. Five grams of the oil are dis-so'ved in ethyl ether and treated with five cubic centimeters of a five per cent ethereal iron chloride solution. After remaining for a period of two hours the precipitate is brought on to a folded filter paper and washed once with ether. After the filter paper has dried out, the open edges at the top are tied together with a string and this is then boiled in a flask with ether as long as oil or paraffin is removed from it. This generally means three to four extractions. Then the precipitate is heated in the same flask with the addition of ch'oroform, which readily dissolves the iron chloride double compound out of the filter paper. The dark so'ution is then brought into a small separatory funnel and treated first with five cubic centimenters of a dilute solution of hydrochloric acid for the purpose of breaking up the double compound. Then it is shaken with five cubic centimeters of water and finally dried. The asphalt that is obtained in this manner is dried at a temperature of 105 degrees C and then weighed.

The process is tested out on six different cylinder oils and a crude oil. The results obtained are contained in the tabulation.

Character of oil	Benzine asphalt per cent	Iron chloride precipitated asphalt per cent
Cylinder oil	0.09	0.47
	0.13	0.84
	0.21	1.1
	0.35	1.38
	0.35	0.99
	0.41	1.37
Crude oil	0.9	2.8

The advantages of the iron chloride process are that it affords quantitative precipitation of the asphaltenes, which is an absolute method instead of the former empirical methods; the process is simplified, for there is no need of laboriously boiling out the paraffin with absolute al-

cohol; the method is cheap. Chemiker Zeitung, 1927, page 190.

Corrosion of Steel by Lubricating Oils—The results of investigations on the action of lubricating, containing small amounts of moisture and alkalies, on steel. The work was carried out in order to obtain data in the deterioration of lubricating oils and the subsequent corrosion of the steel in steam turbines.

Strips of steel were immersed in four different oils for lengthy periods, 400 to 1000 hours, at a temperature of 80 degrees C. A series of experiments were carried out. First tests were made with oils that were perfectly dry, then with oils which contained from 0.1 to 1 per cent of distilled water and finally with oils which contained from 0.2 to 1 per cent of alkali salt solutions. Microphotographs were taken of the steel before and after immersion in the oils.

It was found that in the case where the oils were perfectly dry, practically no corrosion had taken place with the two neutral oils, but in the case of the other two oils, which had been previously used and which contained about 1 per cent of organic acids, noticeable corrosion had taken place.

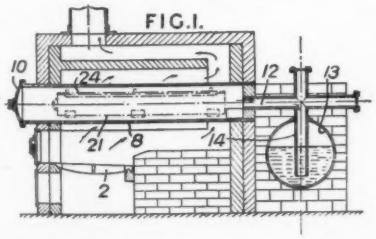
In the case of the oils which contained distilled water, more corrosion was noticed in all cases, but that with the neutral oil was greater than that obtained with oils containing organic acids.

In the third case, where the oils contained alkali salts still more corrosion was noticed and here again the oils, which contained organic acidity, showed less corrosive action than the other two oils.

It thus appears that in the absence of moisture organic acidity promotes corrosion, but where moisture or alkali salt solutions are present corrosion is retarded by organic acidity. The Industrial Chemist, 1926, Dec.

Distilling Hydrocarbons — Heavy hydrocarbons and the like are destructively distilled to yield combustible gas,

FIG.I.



light hydrocarbons and carbon suitable for fuel. Retorts 8 are heated by a furnace 2 receive through a door 10 a horizontal cylindrical container 21 filled with the material to be distilled, and having a longitudinal slot in its upper side covered by a loose lid 24. The heat of the retort causes the liquid to

ASK ANY OF OUR LESSEES ABOUT CONLEY CARS

Our Equipment is in First Class Mechanical Condition

Cars for Gasoline, Fuel Oil, Lubricating Oils
Insulated Cars for Natural Gasoline

CONLEY TANK CAR COMPANY

Magnolia Bldg. DALLAS, TEXAS (*Write or Wire Our Nearest Office*) Oliver Bldg. PITTSBURGH, PA.

To Prevent a Vacuum

The *Fulton Duplex Sensitive Vacuum (or Back Pressure) Regulator* is designed for use on a system discharging gases to a line under light vacuum, where it is desired to maintain atmospheric pressure.

This Regulator acts as a safeguard when used on the vapor lines connected to storage tanks and prevents the pulling of a vacuum when adjusted as a vacuum regulator.

The same regulator may be adjusted to act as a *Duplex Back Pressure Regulator* and will control a slight pressure above atmosphere with the same accuracy as when used to control a light vacuum.

Send for catalogue.

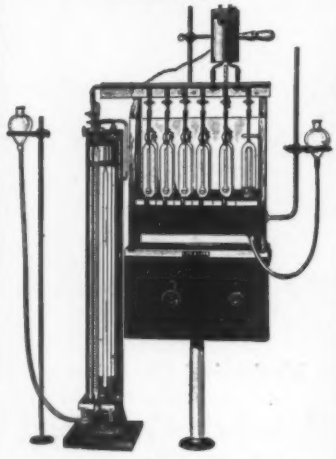
CHAPLIN-FULTON MFG. COMPANY

28-36 Penn Ave., Pittsburgh, Pa.

BURRELL

De Luxe Safety Model

Standard-Burrell Gas Apparatus For the Gas and Oil Industries



Completely Described in the New

BULLETIN NO. 750

A copy will be sent upon request.

Burrell Technical Supply Co.

CHEMICAL-BIOLOGICAL-METALLURGICAL LABORATORY APPARATUS AND REAGENTS

1704-1708 FIFTH AVENUE PITTSBURGH, PA.

boil so that it lifts the lid 24 and flows on to the hot wall of the retort where carbon is formed and vapors are driven off. The vapors pass by pipes 12 and 14 through oil contained in a still 13 and thence to coolers which condense light hydrocarbons. British Patent No. 257,152.

New Acid Proof Paint

A paint which is said to be the only material that effectively seals joints against oil leaks has been developed by the General Electric Company and is sold by the merchandise department at Bridgeport, Conn. The product, known as G-E No. 880 Red Protective Paint, also prevents water and gas leaks. It can be used for many purposes which requires red lead or white lead.

The paint, which is dark red in color, requires no priming and can be applied by brushing or dipping. Denatured alcohol is used as a thinner. It dries rapidly and produces a hard, smooth, glossy film which is easily cleaned and which prevents excessive collection of dirt and conducting material, thereby decreasing surface leakage and subsequent carbonization of the surface when used with electrical apparatus.

One of the first fields in which the paint has been applied is in the manufacture of fuel oil burners, in which one company is now using the material to seal all joints.

More information can be had by corresponding with the company.

New Tag Branch Office

The C. J. Tagliabue Manufacturing Company of Brooklyn, N. Y., maker of industrial instruments, has opened a branch factory at 5902 Carnegie Avenue, Cleveland.

The prime function of the new factory will be repair work, with special attention to emergency orders. The repair facilities of the main factory in Brooklyn have been nearly duplicated, in special equipment, in trained personnel, and in other respects, except only that of size.

In addition to repair facilities there will be maintained stocks of all standardized instruments. The Cleveland factory will, therefore, be prepared to fill emergency orders for standard thermometers, both of the industrial and laboratory types, hydrometers and kindred instruments, oil testing instruments and other laboratory supplies, standard recording thermometers and recording pressure gages, standard automatic controllers for temperature and pressure and various other classes of instruments.

The TAG Cleveland factory is in charge of the district manager, A. R. Anderson. F. A. Denz, F. L. Frock and F. Cramer have also been assigned to special work at the Cleveland factory.

Andrews - Bradshaw Put On New Men

Andrews - Bradshaw Company, Pittsburgh, Pa., manufacturers of the Tracyfier, announce the addition to its personnel of R. N. Robertson, as chief engineer, and A. L. Menzin, as director of research.

Mr. Robertson comes from the American Smelting & Refining Company, having been with that organization for the past 20 years. His work with that company comprised all branches of power plant engineering, and special technical problems concerning the flow of gases, smoke determinations, and as supervisor in charge of all power and mechanical work at all plants in the Western division of the American Smelting & Refining Company. Mr. Robertson is a Cornell man.

Mr. Menzin has had extensive designing, construction, and research experience on steam power plant equipment, having been for some years chief engineer of the Tracy Engineering Company, and prior to that, consulting engineer with the Edge Moor Iron Company, manufacturers of Edge Moor Boilers. Mr. Menzin is a graduate of the University of California.

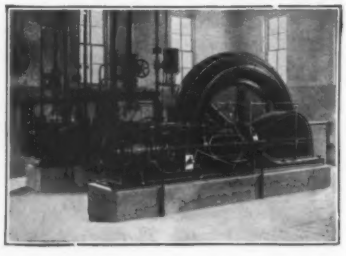
Move Office to Plant

Chicago.—The Osborne Refining Company of Hammond, Ind., has recently removed its sales offices from 35 East Wacker Drive, Chicago, to its refinery. J. C. Crews, sales manager, is also in charge of the plant. The company was formerly known as the Martin Oil & Refining Company.

BONER & SHELDON
Manufacturing Engineers
Fractionating Towers, Absorption Towers, Vertical Stills, Distillation Equipment.
514 Merchants National Bank Bldg.
Los Angeles, Cal.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

Vilter **Ammonia Compressors Fittings and Pipe Coils**
Render Years of Reliable Service



Compressors built in several types and a great variety of sizes. Illustration is of a moderate speed type compressor.

Complete Data on Request

THE VILTER MFG. CO.
Established 1867
1152-1162 Clinton St. Milwaukee, Wis.

BRANCH OFFICE
501 Washington Ave.
Houston, Texas

Advertising Index

American Cast Iron Pipe Company 40
American Cornice Works 119
American Paint & Supply Company 28
American Radiator Company 76-77
Andrews-Bradshaw Company 121
Association of Natural Gasoline Manufacturers 25

Babcock & Wilcox Company 111
Banner Rock Products Company 22
Bessemer Gas Engine Company 24
Biggs Boiler Works Company 45
Bonner & Sheldon 128
Botfield Refractories Company 42
Braun & Company, C. F. ..... Inside front cover
Bristol Company 124
Brown Instrument Company 81
Buffalo Bronze Die Cast Company 120
Burrell Technical Supply Company 128

Campbell, J. A. 20
Chaplin-Fulton Manufacturing Company 127
Chestnut & Smith Corporation 65
Chicago Bridge & Iron Works 29
Conley Tank Car Company 127
Cook Paint & Varnish Company 13
Cooling Tower Company 104
Cooper Company, C. & G. 50
Crane Packing Company 125

Edward Valve Manufacturing Company 118
Elliott Company 43
Electric Controller Manufacturing Company 35

Fisher Governor Company 17
Fluor Construction Company 75
Foxboro Company 116

Garlock Packing Company 129
Gasoline Recovery Corporation 79
General American Tank Car Corporation 117
Goetze Gasket & Packing Company 113
Goulds Pumps, Inc. 93
Great Northern Hotel 113
Graver Corporation ..... Front cover
Griscom-Russell Company 44
Gustin-Bacon Manufacturing Company 36

Hammond Iron Works 41
Henderer's Sons Company, A. L. 111
Hill, Hubbell & Company 33
Hills-McCanna Company 73
Hope Engineering & Supply Company 30

International Compositions Company 109

Johns-Manville, Inc. 14

Kaw Steel Construction Company 9
Kellogg Company, M. W. 18
Kerotest Manufacturing Company 48

Laclede Christy Clay Products Company 71
Liberty Manufacturing Company 4
Lientz Oil Company 107
Lummus Company, Walter E. 19

Metals Coating Company of America 27
Midwest Piping & Supply Company 83
Metalastic, Inc. 123
Metric Metal Works 15
Mettler Company, Lee B. 120
Metallo Gasket Company 126
Merco-Nordstrom Valve Company 5
Mine Safety Appliances Company 102
McCord Radiator & Manufacturing Company 108
McDonald Manufacturing Company, A. Y. ..... Back cover

National Airoil Burner Company 95
National Meter Company 115
National Transit Pump & Machine Company 91
National Tube Company 23
Neilan, Schumacher Company 3
Newton Process Manufacturing Company 16
North American Car Company 85
Northern Equipment Company 114

GARLOCK
TRADE MARK

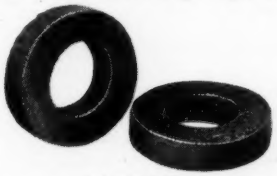
1500° Fahrenheit

A Shredded Metal Packing That Will Stand High Temperatures

ON account of the developments created in the Power Field to produce the highest economies in prime movers, we find ourselves in the age of extremely high temperatures and pressures.

The Research Engineering Department of The Garlock Packing Company have been working hand in hand with the technical staffs of equipment manufacturers to design a packing to meet this new existing condition.

In this we have been successful and we are now offering to the trade Garlock-934 and Garlock-935 High Temperature Shredded Metal Packing. These mechanical packings are manufactured from high heat resisting metal floss bonded under pressure and impregnated with graphite. They will effectively pack against the highest of pressures and withstand heat up to 1500° Fahrenheit.



GARLOCK-934

Garlock-934 is square in cross section and furnished in ring form. Recommended for service on Reciprocating Pistons and Valve Rods.

GARLOCK-935

Garlock-935 is furnished in sets in ring form. Each and every ring is beveled so as to fit into each other. All sets are made with bevelled end rings of superheat solid metal. Recommended for Piston Rods, Plungers and Valve Stems working against high temperatures and pressures. Also gives excellent service on Rods and Plungers of Hot Oil Pumps.

The Garlock Packing Company
Palmyra, New York

Sales Offices and Warehouses in all Principal Industrial Centers

The Standard Packing of the World

YORK
REFRIGERATION
FOR THE
REFINERY

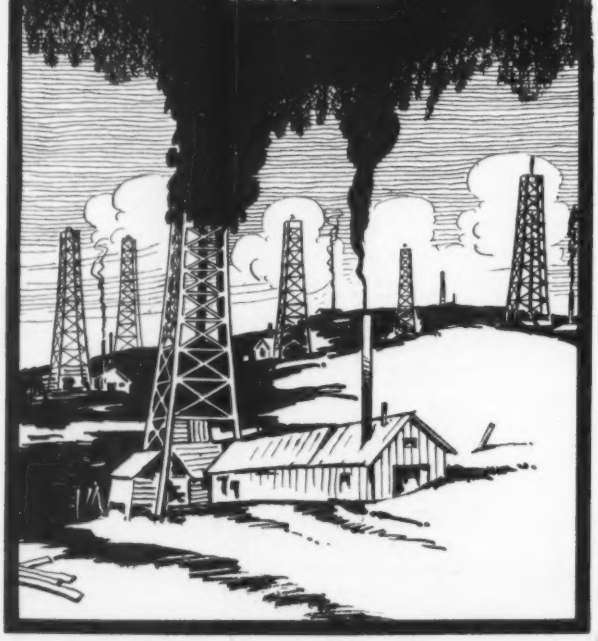
YORK Absorption Refrigerating Machines are built in either the the double pipe, atmospheric, or shell and tube type, and consist principally of the following parts:

GENERATOR, ANALYZER, DEHYDRATOR, CONDENSER, EXCHANGER, WEAK AQUA COOLER, ABSORBER, STRONG AQUA TANK, ANHYDROUS AMMONIA RECEIVER, AND AQUA AMMONIA PUMP.

This equipment is particularly adaptable to Refinery requirements, and can be relied upon to deliver low, dry temperatures WHEN and WHERE needed.

Write the nearest YORK Branch (there are 74 of them) for full particulars.

YORK Manufacturing Company
Ice Making and Refrigerating Machinery Exclusively
York, Penna.



Advertising Index—Cont.

Oaktite Products Company 123
Ohio Steel Foundry Company 12
Oil Conservation Engineering Company 103
Oil Engineering Corporation 125

Paige & Jones Chemical Company 10
Pittsburgh Steel Products Company 101
Plibrico Jointless Firebrick Company ..... Inside back cover
Power Piping Company 112
Power Plant Equipment Company 122
Power Specialty Company 11
Pulmosan Safety Equipment Company 126

Quigley Furnace Specialties Company 69

Refinery Supply Company 117
Ross Heater & Manufacturing Company 89
Roto Company 115

Sarco Company 110
Schutte & Koerting Company 109
Smith Corporation, A. O. 61
Smith Separator Company 46
Southern Cornice Works 121
Southwestern Engineering Corporation 87
Sun Company 8

Texas Company, The 6-7
Texas Fire Brick Manufacturers Association 26
Tulsa Boiler & Machine Works 34

United States Rubber Company 31
Universal Oil Products Company 32

Vilter Manufacturing Company 128
Vogt Machine Company, Henry 38

Walsh Fire Clay Products 119
Walworth Company 63
Waterous Company 106
Westcott & Greis 37
Western Iron & Foundry Company 39
Wheeler Condenser & Engineering Company 21
Williams Valve Company, D. T. 99
Williams, Brown & Earle 128
Wyatt Metal & Boiler Works 97

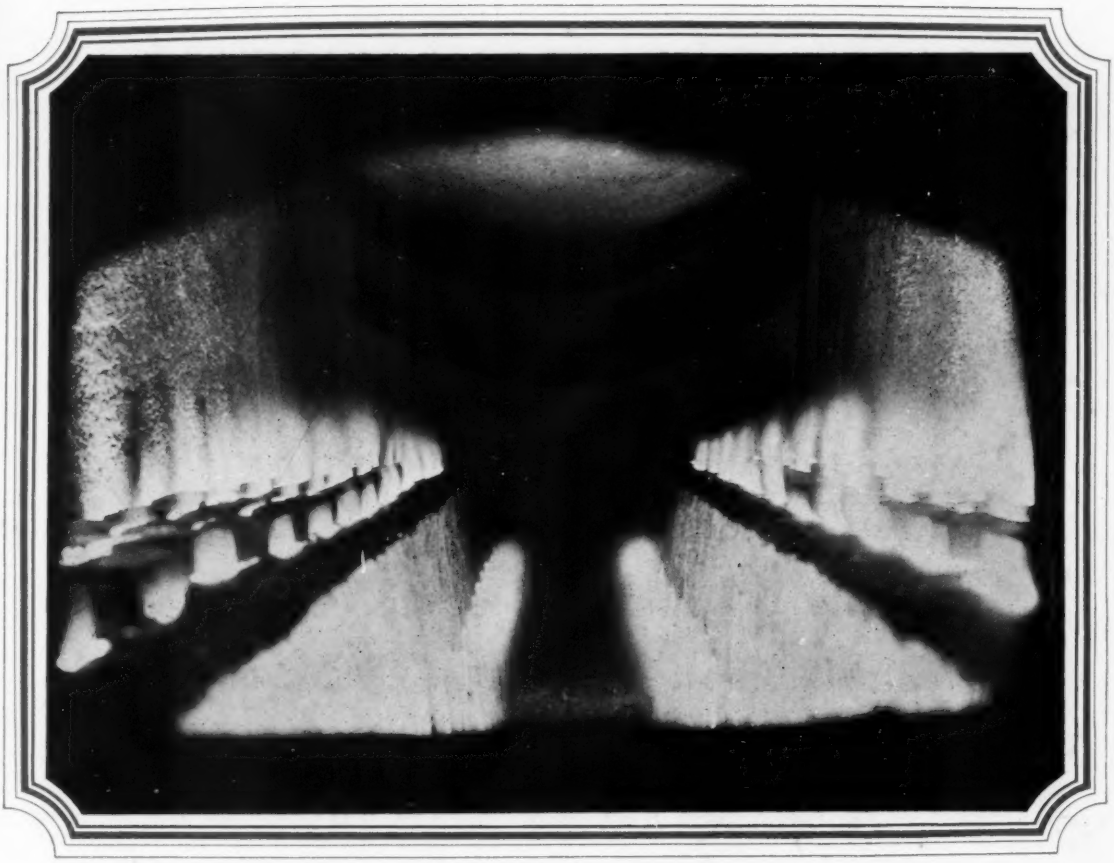
York Manufacturing Company 130

A Modern Publishing Establishment

Our equipment is especially adapted to the publishing of books on petroleum, oil field supply catalogues, oil company house organs, booklets, etc.

Give us an opportunity to figure on your next printing job

The Gulf Publishing Company
Dallas Avenue at Chenevert Street
Houston, Texas



Absolute Uniformity!

THE in-operation photo above shows the uniformity of heat distribution for the entire length of the still that is obtained with the Plibrico Diffusing Furnace (patents applied for).

This uniform heat distribution makes five definite economies:

1—Shortens the time cycle.
2—Gives positive still temperature control.
3—Absolutely eliminates bagging of bottoms.
4—Reduces fuel consumption.
5—Lengthens refractory life.

We will gladly explain in detail how these economies are effected.

The Diffusing Furnace is easily adapted to existing stills at very low cost. It can be used with new stills of any type—shell, pipe, tube, or combination.

There is at least one Diffusing Furnace in every refinery field. We'll gladly tell you where you can inspect this ingenious furnace in operation.

SEND BLUEPRINTS

Our engineering department will gladly prepare buleprints showing an adaptation of the Diffusing Furnace to your stills—without obligation. Send blueprints or rough dimensioned diagrams of your contemplated or existing stills, being sure to show the type of breeching outlet and whether the side walls are straight or slanting.

Plibrico Jointless Firebrick Co.

1865 Kingsbury Street, Chicago

Factories: Chicago and Trenton; offices in 90 cities

Largest producers of plastic refractories

The PLIBRICO Diffusing Furnace

for any new or existing still, oil or gas fired

You lose *from* 2 *to* 8 barrels on *every* car loaded *without* a Universal Gastite Dome Cover. *Figure* the number *of* cars you load *each* year -multiply your loss *and* you will know *how much* actual cash *a* Universal Gastite Dome Cover *will save* you. One refiner *saved* $125,000 *in* 17 months/ *In* addition *they give* Positive Protection *against* inclement weather *and* eliminate danger of explosion~~~

Take advantage of these economies~ Write for full information

UNIVERSAL *Gastite Dome Cover*

PATENTED OCT. 14, 1924

A.Y. McDONALD MFG. CO.

Dubuque, Iowa

OMAHA MINNEAPOLIS DES MOINES KANSAS CITY

"The Home of the Swing Joint"

McDONALD